

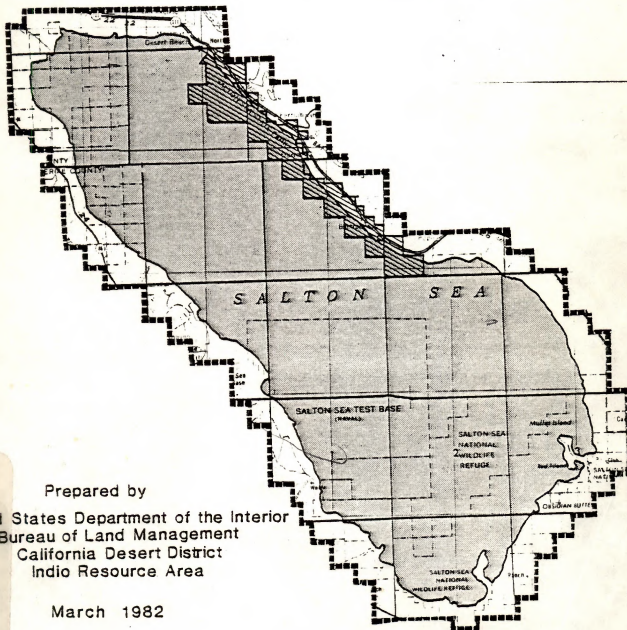


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FINAL

Environmental Assessment #CA-066-2-4

**Potential Impacts Resulting from Leasing
of the
Hydrocarbon Resources at the Salton Sea
Riverside & Imperial Counties, California**



Prepared by

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United States Department of the Interior
Bureau of Land Management
California Desert District
Indio Resource Area

March 1982

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Riverside County, California

Prepared by

United States Department of the Interior
Bureau of Land Management
California Desert District
Indio Resource Area Office

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NOTE: The following items are on file at the Indio Resource Area Office.

- A. Oil and Gas Operating Regulations (43 CFR 3045, Part 221)
- B. Standard Operating Procedures ~~for USGS/BLM Administration of Gas Exploration and Development~~
- C. U. S. Department of the Interior, Bureau of Land Management, Oil and Gas Lease - Surface Disturbance Stipulations
- D. U. S. Department of the Interior, Bureau of Land Management, Offer to Lease, and Lease for Oil and Gas (non-competitive) Application
- E. U. S. Department of the Interior, Geological Survey, Disposal of Produced Water
- F. Regulation Pertaining to Mineral Leasing, Operations and Pipelines on the Outer Continental Shelf (Title 30 and 43 CFR and the Outer Continental Shelf Lands Act (67 Stat. 462))
- G. Correspondence Received During Agency Review Period (January 6, 1982 - February 5, 1982)
- H. References
- I. Parcels of Land Applied for as Oil and Gas Leases within the Salton Sea Study Area

I. Summary of Anticipated Impacts and Conclusions

Resource and Alternatives	Impact Level After Mitigation	Acreage
Geology	No	309,760
Water Resources	Low/No	309,760
Air Quality	Medium	309,760
Climatology	No	309,760
Vegetation and Wildlife	Medium	294,240
	Low	15,520
Cultural Resources	High	4,320
	Medium	12,800
	Low	17,607
	Unknown	49,920
	Unevaluated - Sea Area	225,113
Visual Resources	Low	309,760
Land Use	Low	309,760
Socio-Economics	No	309,760

Conclusions

The Summary Map (Map 1) graphically indicates areas recommended for no surface occupancy by lessees. This zone includes all areas of anticipated high impacts in highly sensitive resource value areas. If accepted, no impacts will occur in these areas. The remainder of the study area has low, medium or unknown impacts and is recommended as suitable for lease.

SALTON SEA E.A.

Summary



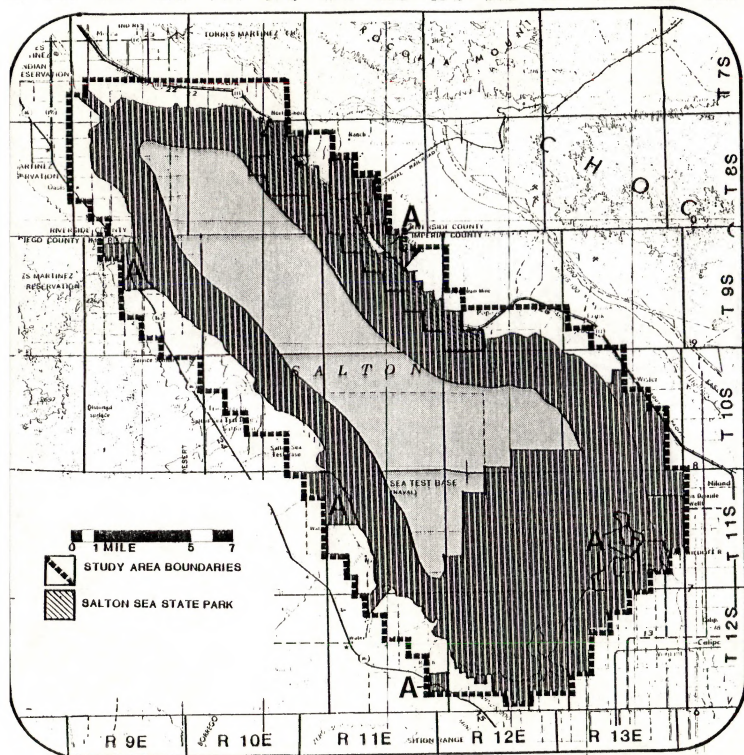
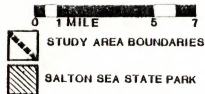
Areas recommended
for no surface
occupancy.

Areas are designated for
wildlife concerns unless
indicated as Salton Sea
State Park or with
an "A" which indicates
archaeological concerns.

Some areas have wildlife
values in addition to
State Park and
archaeological values.



Map 1



II. Introduction and Description of Proposed Action

A. Introduction

Under the Mineral Leasing Act of 1920, and the associated Federal regulations, a Federal lease for hydrocarbon resources is called an "Oil and Gas Lease," and any exploration activities over which the BLM or USGS have jurisdiction are called "Oil and Gas Exploration Activities." Regardless of the type of hydrocarbon resource, if any present, we are obligated to use these terms. The term "Oil and Gas" is used in an administrative sense, and does not imply what type of resource, if anything at all, might be found.

B. Purpose and Need

This Environmental Assessment (EA) is being prepared by the Bureau of Land Management to determine if approval of 40 non-competitive oil and gas lease applications filed under the act of 1920, as amended, would be appropriate for the Salton Sea. There is an undetermined probability of discovering accumulations of gaseous hydrocarbons (natural gas) in structural or fault traps. Due to the exceptionally high geothermal gradient in the study area, the existence of liquid hydrocarbons (oil) is extremely improbable and will not be addressed in this EA.

Natural gas is a clean-burning fossil fuel, and may often be used in areas with stringent air quality regulations. Much of California's natural gas is imported from Texas and Canada. New sources of natural gas must be found to prevent a severe shortage within the next 20 years.

It is the policy of the Bureau of Land Management to provide public land for the exploration, production, and utilization of energy resources. This policy is the result of several Federal laws, primarily the Mineral Leasing Act of 1920, the Multiple Mineral Use Act of 1954, the Multiple Surface Use Act of 1955, and the Federal Mining and Minerals Policy Act of 1970.

C. Issue Identification

The major issues associated with gas leasing in the Salton Sea Study Area are impacts to: (1) wildlife, (2) the visual resource, and (3) recreational uses of the area.

This EA analyzes the impacts that will occur as a result of the proposed leasing action. The document will present analyses of two alternative actions which BLM managers can use as a tool to assess impacts resulting from the proposed action and to make determination in the following three areas:

1. The sensitivity of the study area's resources to gas developments;
2. The need for further study by calling for an Environmental Impact Statement (EIS); or
3. If leasing should occur, under what conditions shall leasing be allowed.

D. Study Area Description

The Salton Sea Study Area is located approximately 20 miles south-east of Indio, California in central Riverside County within:

Sections 25-29, 31-36, T. 7 S., R. 9 E.
 Sections 26-35, T. 7 S., R. 10 E.
 Sections 1-29, 33-36, T. 8 S., R. 9 E.
 Sections 1-36 entire section, T. 8 S., R. 10 E.
 Sections 7, 17, 21, 27-30, 31-34, T. 8 S., R. 11 E.
 Sections 1-5, 9-16, 21-27, 35, T. 9 S., R. 9 E.
 Sections 1-36 entire section, T. 9 S., R. 10 E.
 Sections 3-36, T. 9 S., R. 11 E.
 Sections 19, 25-36, T. 9 S., R. 12 E.
 Section 31, T. 9 S., R. 13 E.
 Sections 1-17, 21-26, 35, 36, T. 10 S., R. 10 E.
 Sections 1-36 entire section, T. 10 S., R. 11 E.
 Sections 1-36 entire section, T. 10 S., R. 12 E.
 Sections 4-9, 15-23, 26-35, T. 10 S., R. 13 E.
 Section 1, T. 11 S., R. 10 E.
 Sections 1-29, W 1/2 32, 33-36, T. 11 S., R. 11 E.
 Sections 1-36 entire section, T. 11 S., R. 12 E.
 Sections 1-26, 31-34, T. 11 S., R. 13 E.
 Sections 1-4, 10-14, 25, 36, T. 12 S., R. 11 E.
 Sections 1-30, N 1/2 34, T. 12 S., R. 12 E.
 Sections 4-8, 18-19, T. 12 S., R. 13 E.

E. Proposed Action and Alternatives

Once the EA has been completed, and if impacts are shown to be of such a nature that they are mitigable and/or acceptable, non-competitive gas leases would be let which would allow exploration, development, production, and related rights-of-way in the study area. This would be accomplished in cooperation with the USGS as stated in the 1972 Secretary of the Interior Order No. 2948 and the Washington Office Cooperative Procedures (Department of Interior, 1975) concerning the division of responsibilities for the administration of onshore mineral leasing laws.

1. Proposed Action:

The proposed action, if chosen, would provide for:

--Preliminary investigation, particularly seismic-type geophysical surveys under 43 CFR 3045.

--Issuance of oil and gas leases in the area by the authority of the Mineral Leasing Act of February 25, 1920, as amended.

--Exploration for hydrocarbon resources, and subsequent development and production of any found under the Mineral Leasing Act of February 25, 1920.

--Issuance of support rights-of-way as necessary for pipelines in the area by the authority of Section 28 of the Mineral Leasing Act of February 25, 1920 as amended by Title I of the Act of November 16, 1973 (Public Law 93-153, 87 Stat. 576).

--Issuance of new rights-of-way necessary to support production, conservation, and transportation of the resource. The authority is contained in Section V of the Federal Land Policy and Management Act (FLPMA) of 1976.

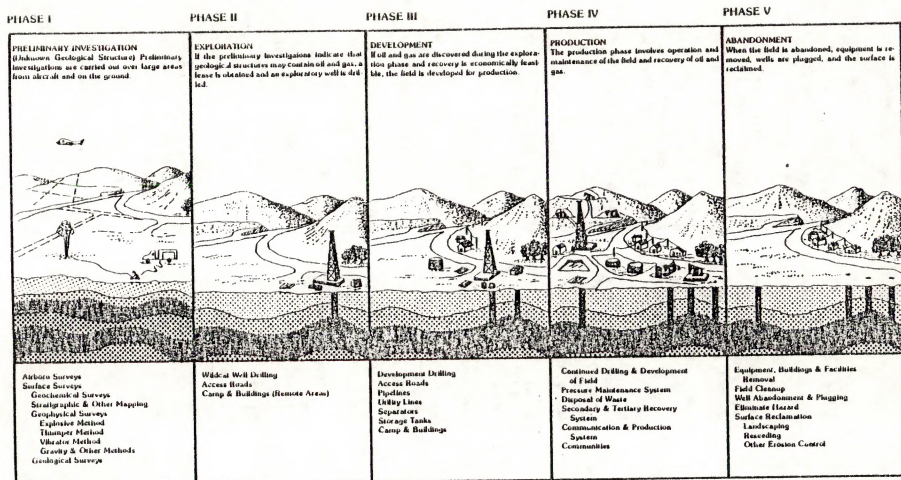
Figure 1-1 shows the sequence of operations in an oil and gas field. The analysis in this EA is made according to the phases shown.

2. Alternative Action/Decision Not to Lease

Under this alternative, the BLM would deny oil and gas lease applications within the study area. This action would provide maximum protection to all resource values at the expense of development of any natural gas resource.

3. Other Alternatives

The proposed action and alternative covers the spectrum of all possible actions conceivable ranging from no development to analysis of development in every portion of the study area. There are almost unlimited possibilities for leasing different combinations of parcels that if analyzed individually would result in a cumbersome and repetitive document. By covering the two extremes, BLM managers will be able to extrapolate the reasonable alternatives in between and reach decisions on what areas are appropriate for leasing and which ones are not. By analyzing these two extreme alternatives, BLM is in no way limiting itself and will consider different permutations found within the scope of the analysis including consideration of leasing only onshore or only offshore.



SOURCE: U.S. Department of the Interior, BLM, 1972

Figure 1-1. Phases or Sequence of Operations in an Oil and Gas Field.

F. Development Model and Assumptions

Quantifying specific surface impacts due to gas development is impossible without a site-specific proposal. However, studies of similar actions in California, and other states, plus recent successful oil and gas drilling in the Great Salt Lake of Utah demonstrates a plausible sequence of events leading to and including the development of the hydrocarbon resource within the Salton Sea Study Area. The following is a discussion of the operations that may be reasonably expected.

1. Preliminary Investigation

An area of interest is studied by 1) review of the geologic literature, 2) detailed examination of aerial photographs and geologic maps and 3) full sampling of outcrops. Following this, a geophysical exploration program is undertaken. Geophysical exploration can be conducted on leased and unleased lands. This work is sub-contracted by companies or done by consulting geologists who may then sell their information to companies. With the information obtained, companies, or others, may request that lands be offered for lease, or they may proceed with exploratory drilling on existing leases.

The Federal Regulations (43 CFR 3045) for oil and gas exploration operations require cooperation between the BLM District Manager, his staff, and geophysical operators. BLM does not require a permit for geophysical operations, but it does require a permit before earthmoving equipment can be used on public lands.

The geophysical industry and BLM mutually developed standards that operators will follow when conducting geophysical operations on public lands. The geophysical operator has a responsibility to cooperate and coordinate his operations with the BLM District Manager.

The geophysical operators requirements are:

--To file, in person or by mail, a "Notice of Intent to Conduct Oil and Gas Operations" (Form 3040-1) for all operations on public lands. The notice includes maps showing the location of the line and all access routes. It must be filed in the BLM District Office before operations begin. The maps should be a minimum scale of one half inch to one mile. Where available, USGS 7.5 minute quadrangle maps should be used.

--To be bonded.

--To notify the District Manager before entering onto public lands.

- To obtain the District Manager's prior written approval before commencing any surface disturbing activities such as with bulldozers.
- To notify the District Manager in writing of any changes in the original notice and secure written approval for proposed changes before proceeding.
- To comply with written instructions and orders given by the District Manager at the prework conference or field inspection before actual work begins and during field investigations.
- To notify the District Manager that his operations are completed and that he is leaving the land listed on the notice.
- To file a "Notice of Completion of Geophysical Exploration" (Form 3045-2) in person or by mail after rehabilitation work is completed.
- To submit an acceptable archaeological survey (if required) if earth moving work is approved.
- To comply with all applicable Federal, State, and Local laws such as the Federal Land Policy and Management Act of 1976, Threatened and Endangered Species Act, Historic Preservation Act of 1966, and others.

a. Onshore

The two most common methods of geophysical exploration expected in this area are drilling shot holes 50 to 200 feet deep and vibroseis or thumper. Drilling shot holes and vibroseis involve the use of heavy truck-mounted equipment.

Shot hole drilling involves four to twelve holes drilled per mile of line. However, the number will vary according to terrain and the size of charge. The holes are normally eight inches in diameter, and are loaded with 5 to 10 pound charges.

Operators sometimes encounter water in drilled shot holes. The water may flow at the surface or it may rise a certain distance in the drill hole. Whenever water is encountered in a drill hole, the hole must be sealed sufficiently to stop the flow of water from the aquifer from which it originates. This can be done by cementing to a depth of 20 feet below the aquifer, through the aquifer, and 20 feet above the aquifer. A five-foot cement plug must be placed in the drill hole two feet below the surface. Another acceptable method is filling

the drill hole under pressure with heavy bentonitic mud from bottom to top. If no water is encountered in a drill hole, a short plug placed seven feet below the surface is acceptable. The hole is then backfilled with cuttings. Drilling of shot holes requires some water. Three to four hundred gallons per day is used by a typical operation.

The most common evidence that a seismic drilling program has been conducted in an area is the presence on the surface of cuttings and mud from the drill hole, and vehicle tracks in the surface soil and across vegetation. The mud and cuttings that are not placed back into the hole are scattered around the drill hole so that a thin layer of mud and cuttings remains. Enough scattering of the mud and cuttings should occur so that low growing vegetation is not covered. The evidence usually disappears within a year.

The thumper or vibroseis methods use truck-mounted equipment to pound or vibrate the earth. Less than 50 square feet of surface area per truck is required to operate the equipment at each test site. If a vibroseis crew does not depart from existing roads and trails, no evidence of their presence can normally be found. If they travel cross country in low growing vegetation, vehicle tracks on the surface and across vegetation can be found.

The method discussed above use truck-mounted recording equipment and small detectors (geophones), placed in contact with the ground at spaced intervals. The geophones record the time it takes the shock wave to return from the subsurface. The seismic equipment is mobile with the exception of small one-half to five-pound geophones and all equipment is truck-mounted. The geophones are located along straight lines laid out by surveyors on a one to two mile grid. Existing roads are used where available. Trails may be cleared of vegetation and loose rock to improve access for the trucks. This, as stated previously, requires a permit. Dropping the dozer blade to clear brush and establish roads is not generally permitted.

A typical seismic operation may utilize 10 to 15 men operating five to seven trucks. If they are backpacking equipment, the same number is usually required. Under normal conditions, three to five miles of line can be surveyed and shot each day in vehicle situation. When backpacking two to three miles per day is a normal average.

b. Offshore

The two most common methods of geophysical exploration use air guns or "sparkers." Explosives, placed on the bottom, are used only rarely. All offshore methods involve the use of a small boat towing a receiving module by a cable. The "air gun" method involves firing a burst of compressed air toward the bottom. The towed receiving module records the time it takes for the shock wave to return from the reflective horizons. The "shock wave" is of very low intensity, and the only disturbance consists of bubbles near the boat. The "sparker" method uses similar equipment, except that a small electric charge is used in place of compressed air. The electric charge is small, and fully shielded. No electric charge or "lightning bolt" is released into the water. Three or four personnel would be required for either method. They would use the boat to cover the area of interest in a grid pattern. The operation would resemble a slow-moving water-skier.

2. Exploration

a. Onshore

Access Roads: In general, access roads to well sites are 16 to 18 feet wide running surfaces that are ditched on one or both sides. The area along the route is first cleared (approximately two to eight acres per mile) of vegetation and rocky debris by blading with a motor patrol. The borrow ditches are cut, and the material used to crown the running surface. A layer of rocks or gravel is often placed on the road to facilitate use during wet periods. Many of the roads constructed would follow existing roads or trails. New road construction usually requires additional equipment such as bulldozers and motor scrapers to move larger volumes of material. Normally, additional culverts are necessary which requires backhoes and/or draglines to clear channels, etc. The vegetation is usually disposed of by burning, burying, or spreading. The method used depends on vegetation type and volume. Roads may be permanent or temporary depending on the success of the well. The initial construction may be for a temporary road; however, it is usually designed so that it can become permanent if the well produces. Not all temporary roads constructed are rehabilitated when the drilling stops. A temporary road is often used as access to other drill sites or for further development. The main roads, and often temporary roads, may require gravelling to maintain them as all weather roads.

Well Site: The well sites are usually two to four acres in size and cleared of all vegetation. The combination of rough terrain and deep wells makes the larger disturbed areas the norm. Construction begins by stripping away all available topsoil. A location with eight inches of available topsoil can yield 700 to 5,000 cubic yards of material which must be stockpiled near the site for later use in reclaiming the area. Small shrubs, grasses and forbs may be mixed with the topsoil or disposed of by burning or burying, depending on the volume and type. Five well sites located onshore are assumed for purposes of this EA.

The dimensions of a pad for drilling to depths of 17,000 to 20,000 feet are about 400' x 475'. The dimensions of the mud pit are about 225' x 175' by 10' to 14' deep. The mud pits may or may not be located on the pad. For a nearby example, the Mobil Oil Company's Virgin River No. 1-A USA well (located 50 miles northeast of Las Vegas, Nevada) has the following dimensions: well pad size - 236' x 425' (not including mud pit); mud pit size: 200' x 100' x 15' 2.76 acres. The mud pit is adjacent to the pad.

A list of items usually found on a location during drilling include:

- Drill rig
- Diesel engines
- Fuel storage tanks
- Water storage tanks
- Drilling mud storage
- Trailers for geology lab or mud laboratory
- Vehicle parking
- Pipe and piperacks
- Trash pit
- Electric generators

The platform is constructed next, using bulldozers and/or motor scrapers. The platform is usually flat, to accommodate the drill rig and its support equipment, and large enough to store all the equipment and supplies without restricting the safe work area. The drill rig itself must be set up on cut, not fill. Use of fill presents the danger of the rig falling over because of unstable ground. The degree of cutting and filling necessary depends on terrain, i.e., the flatter the site, the less the work. Eventually all fill material should be put back into the original cut area. The reserve pits are constructed adjacent to or on the well pad. Pit construction involves excavation and embankment construction to form a pond to hold drilling cutting and fluids. The size and number of pits is dependent of the depth of the well and anticipated down hole problems, i.e., excess water flows.

b. Offshore

Prior to drilling offshore, the drill rig must be mounted on a suitable platform. This platform may be a barge (as used in the Great Salt Lake), an artificial island crested with sand and rock from local quarries (no trash or waste), or a pier.

A recent example of drilling in a large inland lake is Amoco Production Company's project in the Great Salt Lake of Utah. In 1978, Amoco began a drilling program in search of oil. Their projected termination depths were up to 20,000 feet. Their drill rig, operated by Parker Brothers Drilling Company, was mounted on a barge specially designed for conditions on the Salt Lake. The design was developed as a result of study of local and regional seismic patterns, weather, water depth, wind, and wave size, etc. Data from a six-month site-specific wind and wave study by Amoco were also used in the design. The result was a drilling barge designed to withstand severe waves, severe weather, and earthquakes. Both the Salton Sea and the Great Salt Lake are in seismic areas, and both lakes experience high winds and high waves. The barge and attaching equipment were designed to withstand the corrosive action of the Great Salt Lake (Woodhall, 1980), which is more saline than the Salton Sea. As a result of their drilling program, Amoco has discovered oil, and no spills have been reported (Oil and Gas Journal, 1981)

Barges. In shallow water, such as in the Salton Sea, barges are generally the safest and most cost-effective drilling platform. In the Great Salt Lake of Utah, the oil company used a barge assembled from interconnecting modules, each 7 feet deep. The deck area of each module was either 10 by 10 feet, or 10 by 40 feet. The modules were trucked from the manufacturer in Houston, and assembled at the lake by bolting and welding. Because the Great Salt Lake is in a seismic region (a Richter Magnitude 6.1 earthquake occurred near there in 1975), the barge and drilling structure was designed for seismic loading. Their barge was anchored using piles 30 inches in diameter with 1 1/2 inch diameter high-tensile corrosion resistant cables for attachment. Where conditions are favorable, large, heavy anchors may be used. The assembled barge was 180 feet long by 90 feet wide. The barge and anchoring system was designed to limit horizontal movement above the wellhead to less than 1 1/2 feet. A safety disengagement procedure was developed to stop drilling in major storms, where winds exceeded about 50 mph (Woodhall, 1980).

The barge was augmented by the following support vessels: 2 supply barges, 30 x 120 feet; 3 crew and work boats; 1 pollution control barge, 21 x 68 feet; and 1 mud barge, 21 x 68 feet, to retain drilling mud and cuttings.

Because of more readily available lodging facilities on shore, a smaller barge may be used in the Salton Sea, and fewer crew and work boats may be required. The use of a drilling barge is probably the most likely drilling method in the Salton Sea, except for drillsites very near the shore.

Piers. A "limited use fixed platform," or pier could be used as a drilling platform. Such piers require a cohesive sea floor, and must be disassembled and rebuilt if moved. Where the sea floor is of deep mud, piers probably would be impractical. Piles used to support piers are subject to instability due to liquefaction in large earthquakes. Piers could be used for drill platforms near the shore, and probably would require support barges and boats similar to those needed for drilling barges.

Artificial Islands. An artificial island could be used in an area too shallow or unsuitable for the above methods. The island would be as small as possible, and accommodate most of the facilities found on an onshore drill site. Reserve pits would be the same as those onshore, if they could be lined well enough to prevent contamination of the sea water. If reserve pits were not permitted, then barges would be used to contain fluids.

Shore facilities needed for an offshore exploration effort would probably include dock facilities, roads, living quarters for up to 20 personnel per rig, vehicle parking, office facilities, radio facilities (for communication with the rig), etc. About 2 acres per facility would be needed for offices and parking. Five to ten acres per facility on the shoreline would be needed for docks, etc. Where adequate, and the owner is willing, many existing shore facilities could be used. If local accommodations for personnel were not available, they could be housed in trailers at temporary shore facilities, or in accommodations in other, nearby areas.

3. Drilling Operations

Onshore and Offshore

Prior to drilling any exploratory well on a Federal lease, the applicant is required to submit an Application for Permit to Drill (APD) and a Multi-point Surface Use and Operations Plan

to the USGS. The applicant is required to comply with all existing laws, regulations, and USGS Notices to Lessees (NTLS). These requirements are outlined in Appendix A. The applicant also must meet all applicable state and local requirements. The applicant may be required by the State of California to submit a report of waste discharge to the California Regional Water Quality Control Board. Additional requirements to protect water quality may be imposed by the board. The applicant will also be required to submit an application to the appropriate Air Quality Management District (AQMD). The AQMD may impose additional requirements to protect air quality. The requirements of either organization may be greater than those proposed herein.

Drilling commences by setting conductor pipe to a depth of 15 to 20 feet to keep surface sand and dirt from sloughing down the well. Offshore, a stack is placed on the surface above the drill site to keep sea water out of the drill pipe. The stack, which resembles a very large fire hydrant, also houses one or more blowout preventers. Then the rotary drill bit and drill string are rotated and gradually lowered into the conductor pipe as the bit bores into the earth. Another string of pipe called surface casing is set inside the conductor pipe when the hole reaches a depth of several hundred feet. Surface casing is a safety string to protect fresh water and sands, and to prevent the well from "blowing out" if a high pressure zone is encountered. Cement is used to fill the space between the side of the hole and the surface casing to prevent fluids from leaking and to anchor the casing. "Mud" (a mixture of water, clay, and chemical additives) is forced under pressure down the drill pipe to cool and clean the drill bit and to carry cuttings to the surface. If no oil and gas is encountered, the well is plugged with cement and abandoned. If the well is a producer, casing is run to the bottom of the hole and cemented in place.

Blowout preventers are a very important part of the drilling system. Their function is to shut in the well if abnormally high subsurface formation pressures are encountered during drilling. The preventers consist of three different types of seals, which can be closed, in turn, to prevent the hole from uncontrollably flowing.

Slant Drilling

Slant drilling is a useful, but expensive method sometimes used to drill multiple producing wells from one location, or to tap hydrocarbon resources under areas where surface operations may

be technically infeasible or prohibited. Under favorable conditions, slant drilling may be done at a 45° angle, thereby drilling about as far horizontally as vertically. For example, a well drilled to a 13,000 foot vertical depth may also penetrate 13,000 feet (a little less than 2 1/2 miles). However, the rocks encountered must be amenable to slant drilling. Targets in the center of the Salton Sea cannot be explored or tapped using slant drilling from shore.

Waste

Cuttings and drill mud are separated after they return to the surface. The drill mud is returned to a reserve pit or barge, and is recycled. Onshore, the cuttings are disposed of in a trash pit. Offshore, the cuttings are discharged over the side of the rig, shunted through a pipe to the sea floor (to reduce turbidity), or stored in a barge and removed to an approved disposal site. Even if removed, some cuttings and mud may end up in the sea. Because of possible contamination, drilling muds have been developed that contain iron rather than chromium. This type of drilling mud may be used in highly sensitive environments.

On offshore rigs, sanitary waste may be processed on the rig, or may be hauled to an onshore disposal site. On a well-designed platform, all deck drainage would be passed through an oil-water separator, and all oily and contaminated waste would be hauled to an onshore approved disposal site.

The California Regional Water Quality Control Board prohibits disposal of all fluids and waste materials in the Salton Sea and its tributaries. Under state requirements, all drilling wastes, including mud and cuttings, must be removed to an approved site. There is an approved disposal site near Westmoreland, although local authorities may limit disposal of wastes to those originating in Imperial County.

4. Well Site Abandonment and Rehabilitation (Unsuccessful Well)

When a well is unsuccessful, the drilling rig and all support equipment are removed from the location. Normally rehabilitation does not begin until the fluids in the reserve pit have been removed or evaporated. These fluids can be toxic to plant and animal growth, and special care in handling the fluids is necessary. It often requires six to nine months for a reserve pit to dry. When

rehabilitation does begin, bulldozers, motor scrapers, motor patrols, and backhoes or draglines can be used to move the dirt back near its original place. The site is contoured to blend into the adjacent topography. Then topsoil is placed, and the area is seeded. All casing is cut and recovered above a stipulated depth (commonly 10 feet) below the original ground surface to avoid possible subsequent interference with agriculture or other surface activities.

When an offshore well is unsuccessful, the drill rig and platform are often left on site, and another well is drilled directionally. If the site is to be abandoned, the rig and platform may be moved to another site, or removed from the project area. If no wellhead is to be placed on an artificial island, the island may be dredged up and removed, causing a short term increase in turbidity. Or, the island may be left in place and abandoned. If the entire project is abandoned, reclamation of shore facilities would begin.

5. Development and Production

Delineation. Few discoveries go directly from exploration to development. Several additional wells usually must be drilled to properly delineate any resource, and allow the operator to efficiently plan needed support facilities.

Spacing Requirements. In the event of successful exploration, well spacing pattern must be established before development drilling begins. Information considered in establishment of a spacing pattern includes data from the discovery well on porosity, permeability, pressure, composition, and depth of formations in the reservoir; well production rates and type (predominantly oil or gas), and the economic effect of the proposed spacing on recovery. Most spacing for production from Federal leases for gas production is 640 acres per well. When larger spacing units are established, they are usually in multiples of 40 acres.

USGS controls spacing for gas on a Federal lease. All wells must be in the center of a 40 acre legal subdivision with a possible variance of 200 feet in a north-south and east-west direction. Spacing for efficient production from a geological formation depends on such factors as reservoir characteristics and drive mechanisms. If an operator can show that different spacing is needed for maximum recovery, USGS can make exceptions to the rule. Exceptions may be granted provided there are no geologic or legal problems. Where a Federal lease is adjacent to an operation under state control, the USGS cooperates with the California Division of Oil and Gas in the determination of well spacing.

Production in a gas field does not begin until the pipeline to a market has been constructed or tied into. Pipelines are not justified until sufficient gas reserves are proved by drilling operations. Gas wells are often shut-in after completion, for periods ranging from months to years, until pipeline connections are available.

Support Facilities. Once a field is in a development and production situation, the need for support facilities greatly increases. Some of these needs are primarily for production and some are safety.

Pipelines for transportation of the product will be needed. Some of the gas will be going to market and some of the gas may be used in the field for production.

There may be an increase in the number and width of roads. They will be used for access to the shore facilities, maintenance and access to the onshore wells.

Communication needs will increase. Underground telephone lines are the most common today, and will require rights-of-way. Repeater sites may also be needed for telephone and two-way radio.

Power needs will increase. This will require rights-of-way for main lines and rights-of-way to each well site, tank battery, and production office facility.

Surface Uses

Surface uses required for development may include well pads, access roads, flowlines, transportation pipelines, tank batteries, and communication sites. When construction begins on a well site, access road, pipeline, tank battery, etc., vegetation less than three feet high is bladed or a brush beater is used to knock vegetation down. Larger woody species are sawed up and the stumps and bases are grubbed out and removed from the area. Soil material (if available) is removed and stockpiled for redistribution after construction is completed. The dirt work is then done depending on whether a pad, pit, pipeline, access road or communication site is being constructed. Large equipment such as bulldozers; scrapers; backhoes; flatbed trucks carrying pipe, derrick, engines, trailers, etc.; pipelayers; welders; etc., may be present on the lands. They occur during construction, removal operations, and rehabilitation. Their presence at a site is short term.

If a well becomes a producer, the area no longer needed for production is rehabilitated. This is usually the area outside the permanent anchors installed to tie-down workover rigs. The sides of the location are reduced, recontoured, soil material is replaced, and reseeding and/or planting is accomplished. The remaining area of bare ground is approximately one acre. All that will remain on the well site is a gas wellhead ("Christmas tree") and one single lane access road 12 to 16 feet wide.

Offshore, it may be necessary to leave one or more platforms remaining. However, it is more likely that gas wellheads, known as "Christmas trees," may be placed underwater. If drilling was accomplished from an artificial island, the wellhead may be located on the surface of the island, or placed in a vault, out of view. Several wells may be drilled from one drill site in a good location, reducing the number of artificial islands or platform moves needed. Pipelines to carry gas to the shore may be placed underwater on the sea floor, or buried under the sea floor.

If water is produced with the resource, a pit is needed for storage or evaporation. USGS's NTL-2B requirements have to be met in order for such a pit to be approved. If waste oil and grease is anticipated on the water in the pit, protective covering or flagging is required to prevent water fowl from landing in the pit. Produced water is disposed of under an EPA and/or state approved discharge permit, reinjection into the formation from which it was produced, or evaporation from the pit. Pits can range in size from 50' x 50' to 400' x 400'. Size is dependent upon the amount of water encountered during production.

Pipelines

Pipeline rights-of-way are normally 50 feet wide. The actual amount of surface disturbance during construction of smaller gathering lines (four to eight inches in diameter) is about 35 feet. A major transportation line of 24-36 inches in diameter usually has the full 50 feet disturbed, and in some cases additional widths are disturbed. Pipelines can be surveyed so that they do not always run in straight lines. They can be routed around hillsides and vegetation such as trees to provide a camouflage. If pumping stations are necessary, the above ground structures can be painted or camouflaged to blend into the natural setting.

Upon abandonment, underground pipelines are usually left in place to avoid disturbing the surface once again. Surface support structures such as separators, pumping stations, meters, etc., are removed.

Roads

One road to each well pad, pumping station, and shore facility is required. The following table is a generalization of the minimum design standards for common roads:

TABLE 1

Proposed Roadwork Summary Chart

	Single Lane	Double Lane
Width	16-18 feet	25 foot
Average design speed	15-25 M.P.H.	25-35 M.P.H.
Maximum grade	10%	10%
Minimum radius (feet)	65	100
Normal cut slope (back slopes)	2:1	2:1
Normal pitch	4:1	4:1
Upon abandonment, well sites and access roads are obliterated whenever possible. Culverts and other surface improvements are also removed. Revegetation by seeding and/or planting begins.		

TABLE 2

Production Summary Chart

40 Applications Pending In Study Area (8 different companies)	
309,760 acres total study area (484 sections)	
172,147 acres applied for lease (268.98 sections)	
Access roads	4-10 acres/mile of clearing
Well sites (onshore)	2-6 acres/well 5 assumed probable maximum at one time
Shore facilities (onshore-offshore)	offers and supports facilities 2 acres/operator
Shore facilities (offshore)	docks 5-10/acres/operator
Spacing of gas wells	640 acres/well

III. Description of the Affected Environment

A. Introduction

This section describes in summary form those components of the environment which are likely to be impacted by the proposed action and alternatives. Descriptions are commensurate with the expected magnitude and intensity, duration, and incidence of impacts. Complete specialists' reports which contain species lists, methodologies, and other support data, are on file at the Indio Resource Area Office.

Each resource specialist has zoned the study area into zones of High, Medium, and Low Sensitivity. These sensitivity ratings are a reflection of how sensitive an area is to change in addition to how important the values contained in the zones are on a desertwide perspective.

In each resource section, the criteria used for defining the zones is provided along with a map showing the locations of the zones. In cases where only one sensitivity value has been assigned, no map is provided.

B. Non-living Components

1. Geology

Physiography and Topography

The study area is located in the Salton Trough Province, a north-westerly extension of the Gulf of California. The area is about 200 feet below sea level, and all natural drainage is into the Salton Sea.

Structural Geology and Tectonics

The study area is in an active tectonic region known as the Salton Basin. This is a subunit of the Salton Trough which has been formed by the subsurface presence of the east Pacific Rise, a zone of active crustal rifting extending northward through the Imperial Valley. The overall tectonic control of the Salton Basin is through the strike-slip fault systems of the San Jacinto and San Andreas - Sand Hills Fault networks. The study area falls between these two fault zones.

Within the south part of the study area are the northern segments of the Brawley and Calipatria faults. Subsidiary block faulting within the rift zone has produced extensive basinal subsidence since Miocene times. Sediment thickness in the graben structures ranges from 6,000 to 23,000 feet. More detailed descriptions of the structure and tectonics may be found in Elders (1979), Dibblee (1954), and in numerous other sources. As a result of this extensive tectonic activity, the Salton Sea area has one of the highest geothermal gradients known in the world, in the range of 7.5 to 10°C/100 m (LLL, 1977; Brooks, USGS, pers. comm., 1981).

General Stratigraphy

The oldest rocks presumed within the study area are subsurface igneous and/or metamorphic rocks of possible late Mesozoic age. They do not crop out within the study area and are not reported in available logs of wildcat wells. The oldest sedimentary unit that may occur in the study area is the Split Mountain Formation. This formation, non-marine conglomerate and sandstone of early to middle Miocene age, rests uncomfortably on Paleozoic to Cretaceous erosional surfaces (Morton, 1977). Outside the study area, asphalt nodules have been reported from Loop Wash, on Split Mountain Creek (Faull, 1978 in Guzman, 1981), presumably in the Split Mountain Formation. If present in the study area, the Split Mountain Formation would be in the subsurface.

Stratigraphically above the Split Mountain Formation is the dominantly marine Imperial Formation. The age of the Imperial Formation has been variously reported late Miocene to middle Pliocene. In drillers' logs, this unit is generally reported as "Miocene Marine." This formation may be correlative with that in which Pemex discovered substantial natural gas in Mexico at the mouth of the Colorado River.

Quaternary volcanic rocks consisting of rhyolite, pumice, and obsidian crop out at the southeast end of the Salton Sea (Morton, 1977). These volcanic rocks are associated with the Salton Sea geothermal field. Other Quaternary deposits in the study area consist largely of clay and silt of the ancient Lake Cahuilla.

Hydrocarbon Resource Potential

Since at least 1948, the region of the study area has been considered by many to hold low potential for hydrocarbon accumulations (Beal, 1948). Exploratory wells rarely exceeded 6,500 feet. Some logs report hydrocarbon traces, and many report "unusually high temperatures." In early 1981, Mexico's state-owned Petroleros Mexicanos discovered commercial quantities of natural gas in the Gulf of California, about 50 miles south of Mexicali. The producing formation, at a depth of about 13,520 feet may be on trend with potential deep Miocene prospects in the Imperial and Coachella Valleys, and the Salton Sea study area (Oil and Gas Journal, 1981).

Hydrocarbon accumulations (oil and/or gas) are formed by the decomposition of organic matter. This organic matter generally occurs in a marine environment, although it may form in a continental (epieric) or brackish environment. An appropriate amount of heat (the geothermal gradient) is required to turn this organic matter into hydrocarbons. If too little heat is applied to the organic matter, few hydrocarbons are produced. If too much heat is applied, the hydrocarbons are "cooked" out, leaving graphite or asphalt.

Within the heat range, either oil or gas or both, may be formed. A higher geothermal gradient will cause more gas to be formed. A very high geothermal gradient will generally allow only gas (Hunt, 1979). Depth of burial also has an effect. Gas is more likely with increasing depth. The hydrocarbons, less dense than their host sediments migrate upward through pore spaces until they are stopped by an impermeable layer called a "trap." If there is no impermeable layer, the hydrocarbons diffuse into the atmosphere, and are lost. Traps are often caused by structures (domes or anticlines), or by faults. Sometimes, within an otherwise unfavorable area, tectonic, or fault, activity can cause fault traps or local structural traps that may contain hydrocarbon accumulations.

The Salton Basin has one of the highest geothermal gradients in the world, 7.5 to 10°C per 100 meters. This is evidently the cause of the "unusually high temperatures" noted in drillers' logs and has created significant resources of geothermal energy. Another effect will have been to alter hydrocarbon accumulations to the gas phase, or remove all volatile hydrocarbons completely, leaving graphite or asphalt. According to Hunt (1979) at a depth of 10,000 feet, a geothermal gradient of 5°C/100 meters will create only gas. With a geothermal gradient of 8°C per 100 meters, Hunt's model can be extrapolated to gas alone (if any hydrocarbons at all) at a depth of about 5,000 to 6,000 feet. This is at or above the anticipated target depth for hydrocarbon accumulations in the study area. At greater depths, gas is even more likely, although all hydrocarbons may have been removed. If any hydrocarbon accumulations are present within the study area, they will be in all probability, gas. Due to the extremely high geothermal gradient within the study area, the probability of liquid hydrocarbon (oil) accumulations is overwhelmingly remote. Accurate quantification of the probability without drilling data is not possible, but the probability of liquid hydrocarbons can be safely placed at substantially under one percent.

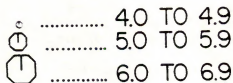
Geologic Hazards

Seismicity

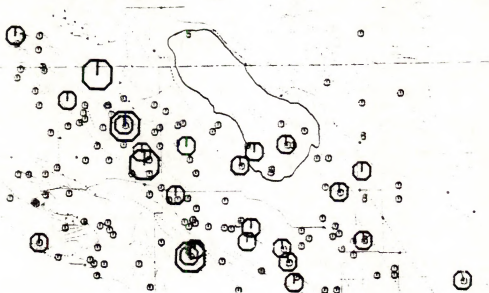
Occasionally, the intensity of an earthquake is described using the modified Mercalli Scale. While the Richter Scale, most commonly reported in newspapers, is a measure of the energy released by an earthquake, the modified Mercalli scale describes how much "shaking" an earthquake produces, on a scale of I (detectable only by instruments) to XII (causing almost total destruction). Where the Richter Scale indicates the energy released by an earthquake, the modified Mercalli Scale is an indication of how the quake "feels." The amount of "shaking" felt at a given place in an earthquake is partly dependent on the ground at that spot. Generally, unconsolidated sediment tends to increase shaking, but bedrock reduces shaking. Thus in a given earthquake of Richter Magnitude 6.0 may cause strong shaking on farmland or sand, but may cause only minor shaking on bedrock, or well-consolidated alluvium.

EARTHQUAKE EPICENTER MAP
(from Real, et al. 1978)

RICHTER MAGNITUDE



INTEGER: Maximum reported Mercalli Intensity. (Only
for earthquakes of unknown Richter Magnitude)



Note: Recent Significant Events After This Map
Published:
October 1979: 12 miles SE of border,
Richter Magnitude 6.7

May 1980: NE of Westmoreland,
Richter Magnitude 5.7 (see text)

The region has a long history of seismic activity (see fig. 1). As recently as October, 1979, an earthquake with Richter Magnitude 6.7 centered in Mexico struck the area. This earthquake caused some surface offset, and damaged many buildings. This quake was followed by aftershocks of Richter Magnitude 5.6 and 5.0. In May, 1980, an earthquake of Richter Magnitude 5.7, centered near Westmoreland, damaged several old, poorly reinforced masonry buildings in that town. Notably, no geothermal wells or facilities at Brawley or East Mesa (east of El Centro) were damaged in either earthquake (R. C. Sones, DOE, 1980, pers. comm.; Imperial County, 1981). While some surface facilities for geothermal energy differ from those used in oil and gas, the wells are nearly identical. The lack of damage to the existing geothermal wells in either event is significant.

Subsidence

Naturally occurring subsidence is a major phenomenon in the region at this time. The USGS reports ~19 inches of vertical movement between 1972 and 1978 at Niland. Imperial County (1981) reports a natural drop of about 1 inch per year in the area surrounding the Salton Sea Geothermal field, in the southeast part of the study area. Similar subsidence may be inferred for the study area as a whole, with local variations.

Outside the study area, on the northeast margin of the Salton Sea, numerous northwest-trending ground fractures have been noted (Buckley, et. al., 1977). It is uncertain if they have been caused by seismic activity, or subsidence due to groundwater removal.

Sensitivity Rating

There are several occurrences of tufa of the ancient Lake Cahuilla shoreline within or near the study area. They are limited in outcrop, and easy to avoid. It is unlikely that anyone would want to drill on these outcrops. For geologic purposes, the study area has low sensitivity.

2. Water Resources

The Salton Sea is a saline body of water approximately 36 miles long and 10 to 15 miles wide, bordered by the Coachella Valley to the north and the Imperial Valley on the south. It occupies the lower portion of the Salton Trough, with a water surface elevation approximately 235 feet below sea level.

The total volume of water in the Salton Sea exceeds six million acre-feet. The deepest point is less than 50 feet (15 m) deep, and in most places the sea is less than 30 feet (9 m) deep.

About 1,200,000 acre-feet of water entered the Salton Sea in 1979 from the New and Alamo Rivers as well as via drains that flow directly to the sea. About 635,000 acre-feet of this water was in the Alamo River, almost all of which originated as agricultural drainage in the United States. Approximately one third of the water imported into the valley by the Imperial Irrigation District becomes drainage water, which enters the Salton Sea.

Salton Sea water is of the sodium chloride type, similar to ocean water. The salinity of Salton Sea water has gradually increased in recent decades, since water loss is almost exclusively through evaporation. Since about 1963, the salinity of water in the Salton Sea has been greater than that of ocean water. The increasing salinity is due to evaporation which results in concentrating the large amounts of salt entering the sea each year.

Since 1935, the Salton Sea has been gradually rising (Winchester, pers. comm., 1980). This increase in water level has been attributed to higher than average rainfall and increased inflow from agricultural runoff. Due to the increased volume the salinity has declined gradually in recent years although as stated above, the overall trend is an increase in salinity. Highest sea levels are during April through June, and lowest sea levels are in October and November.

Chemical constituents carried to the Salton Sea in drainage water include pesticide residues and biostimulatory substances (e.g., nitrogen and phosphorus).

The Salton Sea is characterized by an overabundance of mineral nutrients, mainly compounds of nitrogen and phosphorus. These produce intensive "blooms" of floating microscopic plants (phytoplankton) in upper levels of the water body. The visible results are discoloration and reduction of clarity of the water. In addition, death and decomposition of large populations of these algae often result in odiferous anaerobic conditions. The limited stimulation of the algal growth, however, does have some beneficial effects to the fishing at the Salton Sea.

The increasing trend in salinity raises serious questions to the continued existence of the fishery. Present total dissolved solid concentrations must not exceed "approximately 40,000 mg/l for the fishery to survive" (CRWQCB, 1975). TDS concentrations have been reported to be 39,500 mg/l on December 11, 1979. By contrast, ocean water is 35,000 mg/l.

Groundwater

The major sources of groundwater recharge at present are seepage of excess applied irrigation water and canal seepage, both of which are derived from the Colorado River. The principal area of groundwater discharge is the central cultivated part of the Imperial Valley. Here groundwater moves into the Alamo and New Rivers, as well as into numerous agricultural drains. The ultimate discharge point is thus primarily the Salton Sea. Networks of ditch and tile drains extending throughout the cultivated area have been constructed to alleviate waterlogging due to shallow groundwater. Shallow groundwater levels in the uppermost materials are now stabilized at depths ranging from 5 to 20 feet (1.5 to 6.1 m) below the land surface.

Groundwater basins bordering the northern Salton Sea include the West Salton Sea Basin, the East Salton Sea Basin and the Coachella Valley (DWR, 1975). Analyses of well samples taken between 1950 and 1956 indicates brackish water underlies the entire West Salton Sea Basin (CRWQCB, 1975). TDS concentrations ranged from 2,241 to over 16,000 mg/l. Brackish water is also found in most parts of the East Salton Sea Basin. Well samples analyzed through 1972 exhibited TDS concentrations ranging from 988 to 24,000 mg/l (CRWQCB, 1975). Groundwater in both the East and West Salton Sea Basins has been developed to a very limited extent due to poor quality (high hardness) for either irrigation, domestic, or industrial use.

The Coachella and Imperial Valleys are extensively developed for irrigation and municipal use (DWR, 1975). In the vicinity of the Salton Sea, however, a sedimentary layer of predominantly clay overlies the developed aquifers. Lenses of permeable sediments within the clay layer contain relatively poor quality water and are recharged primarily by irrigation drainage. The groundwater which exists above the clay layer is unfit for irrigation use (CRWQCB, 1975).

Within the study area, Frink Spring and several other unnamed springs maintain a perennial flow, which is probably caused by leakage from the irrigation canals. There is no flow data available for these springs.

Regulatory Aspects

There are no specific standards for groundwater quality in the study area, except for the EPA drinking water standards. These standards would apply to groundwater use for public supply. However, waste discharges that could significantly impact groundwater quality are

covered under the Porter-Cologne Act permit system. The California Regional Water Quality Control Board (CRWQCB), Colorado River Basin Region, is the agency with primary regulatory responsibility. Permits issued by this agency contain limitations on types of wastes to be disposed, composition of wastes, and methods of waste disposal. Also, monitoring programs can be required to verify impacts on groundwater. The California State Division of Oil and Gas has additional regulatory responsibility specifically related to injection wells.

Sensitivity Ratings

The entire study area has been given a high sensitivity rating due to the tenuous health of the Sea. Because the Salton Sea is a center of wildlife, recreation and tourism for the Imperial and Coachella Valleys, any major change to this area which advanced the decline of the water quality would have major negative impacts.

Consult the North Salton Sea Geothermal EAR (1978) and the Westec Magma Geothermal EIR (1981) for additional information on the water resource.

3. Air Quality

Federal and State Air Quality Standards

Presently, certain air quality standards are mandated by both the Federal and state governments. The major objectives of these standards are to protect the public from any known or anticipated adverse effects from air pollution. These standards are generally set conservatively to allow a margin of safety. California Air Quality standards are based on health effects and represent desirable levels of air quality which, on the basis of present knowledge, are expected to prevent health hazards or incipient degradation of health due to air pollution.

Existing Air Quality

The study area is located within the Southeast Desert Air Basin (SEDAB) covering the Imperial, Coachella and Antelope Valleys eastward to the California border. Particulate matter, especially emissions from agricultural activities including dust generated from disturbed soils, is the primary air quality concern in the study area. Air quality for regulated gaseous emissions is recognized as being excellent.

In addition to the parameters monitored or controlled by rule or standards, there are additional considerations that affect people's perception of air quality. In the study area these concerns typically include fumes, dusts, odors or gaseous emissions either

exempt from air pollution rules or for which no standard has been promulgated. Examples of such emissions include odors from agricultural operations (feed lots, manure compost, alfalfa drying, etc.) or ammonia fumes from fertilizer processing and application. Agricultural odors are specifically exempt from air quality rules, while others, if they impact a significant population, may be abated under air pollution district odor nuisance abatement authority.

The study area has not exceeded Federal standards in ozone in three years and, according to EPA guidelines, should be designated as an "attainment area" for ozone. However, there have been violations of California ozone standards. Sulfur compounds in the form of sulfur dioxide or sulfate particulates are very low. Lead, an indicator of vehicular activity levels, is also well below the standard and improving every year.

Particulate matter, on the other hand, is among the highest in all of California. In 1979, dust levels exceeded the state standard on nearly every day that they were measured. These high dust concentrations were observed in El Centro and to an even greater extent in Brawley and Calexico. The low sulfate and lead levels in these particulates suggests that the dust is primarily inorganic silicates from cultivated land or disturbed desert soils. Fortunately, such dust tends to be of a larger diameter more readily filtered by the human breathing passages and is therefore not as closely associated with the adverse health effects resulting from the very small aerosols in urban smog. Since the Coachella and Imperial Valleys are expected to continue as major agricultural producers well into the future, it is similarly anticipated that they will continue to be in violation of state and Federal particulate standards. Standards to separate the total dust burden into a fraction that is non-respirable and can be inhaled have been proposed. At this time, however, the equipment to separate and measure microscopic dusts is still under development. If and when such equipment is developed, a better definition of Imperial Valley particulate matter/health implications and future dust levels can be formulated.

While the aerial extent of air quality measurements is limited to El Centro and particulate data from Brawley and Calexico, these data should be quite representative of the Salton Sea Study Area as well. An extensive air quality and meteorological baseline study by Lawrence Livermore Laboratories from 1976-1978 throughout the Imperial Valley demonstrated a fairly homogeneous air quality distribution. Ozone levels in the Salton Sea Study Area were slightly higher and particulate levels were somewhat variable depending on the intensity of agricultural activity near the site. Otherwise, the general conclusion of low gaseous pollutants and high dust levels is a county-wide phenomenon well characterized by the El Centro data.

For additional baseline data, reference the Westec Magma Geothermal EIR (1981).

4. Climatology

The climate of the study area is dry with hot summers and pleasant, mild winters. Extrapolating wind characteristics from El Centro, the prevailing wind is from a westerly direction for all months except July and August when it is from a southeasterly direction. Four to five times per year, Santa Ana type winds flow down the Coachella Valley.

For additional information see the North Salton Sea Geothermal Environmental Assessment Record (1978).

C. Living Components

1. Vegetation Habitat Types

The distribution and diversity of plant communities in the study area are influenced by the past and present level, flow rate, and quality of water entering and remaining in the Salton Sea. The vegetation varies from sparsely distributed salt-tolerant species in extremely alkaline areas to lush and diverse wetland species in the freshwater marshes fed by river deltas and agricultural runoff. This vegetation is dynamic through time, adjusting to fluctuations in the level of the Salton Sea. Vegetation patterns are also adapting continually to new deposition of sediments at the river deltas feeding the sea. As new sediment is deposited, the bare strands created are colonized by plant species in a succession depending upon the evolving ecological conditions. Conversely, as the sea rises and inundates older deltas, marshes, and mudflats, salt-sensitive plant species succumb while more salt-tolerant species recolonize the area. Water quality of the agricultural runoff entering the sea also affects plant growth. This runoff contains salts, pesticides, herbicides, and fertilizers that are leached from cultivated fields. Although the fertilizers may contribute somewhat to the luxuriant growth in some of the marshes, the dissolved salts in the runoff may limit the diversity of freshwater plant species. In summary, the factors most important to plant growth patterns around the Salton Sea are moisture availability and soil/water salinity.

Vegetation types defined within the study area were based on major differences in vegetation and substrate, and were derived mainly from the classification system of Cheatham and Haller (1975). The distribution of vegetation types was compiled using information from Landsat satellite images (classified by NASA's Jet Propulsion Lab and interpreted by BLM's Desert Plan Staff, California Desert Conservation Area Plan, BLM, 1981), Salton Sea Anomaly Master EIR (Westec, 1981), North Salton Sea Geothermal EAR (BLM, 1978), and the Botany and History of the Whitewater Marsh Area (Prigge, 1981). The following are the ten major vegetation types defined in the study area and will also serve as habitat types for wildlife:

- a. Creosote Bush Scrub
- b. Sandy/Low-cover Desert Scrub
- c. Desert Microphyll Woodland
- d. Riparian Woodland
- e. Alkaline sink scrub
- f. Freshwater Marsh
- g. Mudflats
- h. Barren Areas
- i. Agriculture
- j. Salton Sea

2. Wildlife

Aquatic

Zooplankton

Four invertebrates, a rotifer, a copepod, an annelid worm, and a barnacle comprised the majority of the zooplankton in a study by Carpelan (1961). These are utilized by zooplankton-feeding fish and are important first food for larval fishes. In addition, there are several recently introduced invertebrates such as the snail Thiara granifera and the amphipod Gammarus marinus (Dr. Oglesby, Pomona College, pers. comm.).

Brachionus plicatilis (Muller) - This species was the most numerous species found in summer plankton. Carlen found them most abundant from July through September. December through May only dormant eggs and encysted forms were found. The majority of production contributed to the detritus element.

Cyclops dimorphus (Kiefer) - This species was also very numerous in summer zooplankton. Cyclops serve as food for young bairdiella and were a major food component for fish smaller than 70 mm (two and three-quarter inches). Like the rotifer the majority was utilized as detritus (Carpelan, 1961).

Balanus amphitrite (Darwin) - The barnacle is present in zooplankton during naupliar and cypris stages. Carpelan found the greatest concentrations of planktonic barnacles near shore, where attachment locations and consequently adults were found. The cyprids apparently begin to settle in large numbers about March and continue to settle through October. Barnacle settlement and growth, particularly during the summer in the Sea, is very fast. Solid objects in the water are generally covered within days. Adult barnacles are a predominant food item for adult sargo.

Neanthes succinea (Frey and Leukart) - The "pileworm" spends its adult life in the bottom mud and among the barnacle masses feeding on detritus. Mature worms leave their burrows to swim to the surface at night to spawn and then die. Spawning takes place year round with a reduction in activity during the summer. Spawning increases over the fall and winter culminating in a peak during the spring (Carpelan and Linsley, 1961). Neanthes are generally most abundant at depths between 15 and 25 feet. They utilize the organic rich depths of greater than 25 feet during the winter months, but are eliminated there during the summer months, apparently due to anoxic conditions. Depths shallower than 15 feet generally do not have the organic material necessary to support Neanthes in significant numbers (Carpelan and Linsley, 1961).

Neanthes is an important key in the food chains of the Salton Sea. Bairdiella feed almost exclusively on Neanthes. Bairdiella, in turn, is the major food source for the orange-mouthed corvina, the dominant sport fish in the Sea.

Fishes

There are nine species of fish in the Salton Sea. Four of these are game fish.

Game Fish

- Orangemouth corvina (Cynoscion xanthulus) - Corvina is the most sought after gamefish in the Salton Sea. In fact, party boat fishing for corvina in the Sea is probably the most successful in the state, including marine fishing (Glen Black, California Department of Fish and Game, pers. comm.).

Corvina feed first on zooplankton switching soon to Neanthes. Young corvina compete with Bairdiella at this stage until the corvina are of sufficient size to begin taking Bairdiella and other smaller fishes. Jordan and Gilbert, 1961, felt that this competition for Neanthes may be the limiting factor for corvina in the Sea. Corvina are pelagic, traveling throughout the sea in search of schools of smaller fish.

Corvina spawning habits are unknown. There has been speculation that corvina may utilize the freshwater inlets of the sea to spawn, but there is no conclusive evidence. There is also no information on the requirements of young corvina in the Sea. It is not known whether they need brackish or even fresh water to thrive.

- Sargo (Anisotremus davidsoni) - Sargo are found throughout the Sea in association with adult barnacles upon which they feed.

- *Bairdiella* or White croaker (*Bairdiella icistius*) - *Bairdiella* are extremely abundant, and are the major source of food for corvina. Jordan and Gilbert (1961) noted regular seasonal movement in the *Bairdiella* as they moved in to shallower water in late summer and into deeper water during the winter. This is not totally understood, but Jordan and Gilbert thought it may have been partially due to the availability of *Neanthes*.

Bairdiella spawn in the spring; their eggs and fry have been found throughout the sea, floating just beneath the surface. Heavy wave action can disperse them throughout the water column (Whitney, 1961).

- *Tilapia* (*Sarotherdon* spp.) - These fish were first introduced into the irrigation ditches of Imperial County for weed control, but have since then spread to the Sea. There is some evidence that *tilapia* larger than 75 mm (3 inches) feed on algal mats (K. F. Kline, unpublished data through Westec Services, Salton Sea Anomaly Master EIR). This fish provide a prey base for corvina that is not dependent on *Neanthes*.

Non-game Fish

- In addition, there are five other non-game fish which play a role in the Salton Sea ecosystem. The threadfin shad (*Dorosoma petenense*) is a plankton eating food fish for corvina found primarily near freshwater inlets. Freshwater is required for spawning. Mosquitofish (*Gambusia affinis affinis*) and sailfin mollies (*Poecilia latipinna*) feed primarily on detritus and algae and are most numerous in and around freshwater inlets although mollies are also common along protected shorelines. The longjaw mudsucker (*Gillichthys mirabilis*) is an important bait fish for corvina. The desert pupfish (*Cyprinodon macularius*) is the only endemic fish in the Sea and is discussed under the Sensitive Wildlife Species Section.

Avian Fauna

The Salton Sea supports abundant, varied, and unusual bird life on a national scale. Hundreds of thousands of passerines, raptors, ducks, geese, gulls, terns and shorebirds utilize the sea representing over 250 species. A number of species recorded here are not found regularly anywhere else in the state (Dunn, 1977 and Small, 1974). Breeding birds include California's only breeding colony of Gull-billed Terns (Small, 1974). Snowy Plover, a species of special concern for the California Department of Fish and Game, breed on the undisturbed beaches of the Salton Sea. A recent survey by Fish and Game documented 185 adult birds at the Salton Sea. Heron, egret and cormorant rookeries occur in marsh-riparian habitats bordering the Salton Sea (Clyde Edom, California Department of Fish and Game, pers. comm.). The area is also very valuable for the migrating passerines funneled through the Coachella Valley each fall and spring.

Two refuge systems are maintained at the Sea to attract and hold waterfowl in order to reduce crop depredation and to manage waterfowl hunting. These are the Salton Sea National Wildlife Refuge and the Wister and Finney-Ramer Units of the State Imperial Wildlife Area. In addition, there are many private duck clubs within the study area. Most of these duck clubs flood existing agricultural fields during the waterfowl season to attract waterfowl. The location of these duck clubs can change from year to year.

Comprehensive studies in the activity and use patterns of birds at the Salton Sea have not been done, but general patterns have been noted by state and Federal refuge personnel on ground and aerial censuses. The entire Salton Sea is used as a rafting area for waterfowl. Two of the most common species Ruddy Duck and Eared Grebes utilize the Sea fairly uniformly. The Sea also serves as a refuge for waterfowl when hunting pressure is high. The area within 2 miles of the shore is generally considered a rafting concentration area for diving ducks and other water birds with numbers usually the highest near freshwater inlets (Dean, Salton Sea National Wildlife Refuge Manager, pers. comm.).

The mudflats generally associated with freshwater inlets and manmade mudflats are important feeding areas for shorebirds. Marshes associated with these freshwater inlets provide habitat for the California Black Rail and Yuma Clapper Rail (See the Sensitive Wildlife Species Section).

Agricultural fields are important feeding areas for marsh and wading birds such as White-faced Ibis, Sandbill Crane, herons, egrets, Whimbrel, Long-billed Curlew, Marbled Godwit, Willet, other shorebirds and raptors (Clyde Edom, California Department of Fish and Game, pers. comm.).

The Salton Sea is a very popular birding area attracting visitors from all over the United States and abroad. There are good birding spots all around the sea, but some major spots of interest are the Whitewater delta, Salton City and Salt Creek, the refuges and deltas of the New and Alamo Rivers.

Mammals

The majority of mammals found within the study area are fairly typical of the lower elevations in the Colorado desert. However, the riparian areas provide habitat for muskrat (Ondatra zibithica) and beaver (Castor canadensis).

Reptiles and Amphibians

The reptile and amphibian wildlife species are fairly characteristic of the lower Colorado desert and agricultural areas of Imperial County. The area is within the range of the flat-tailed horned lizard, but no optimal habitat as identified by Turner et. al., 1980, is within the lease area.

Sensitive Plant Species

A sensitive plant species is defined as a rare, threatened, and/or endangered species that merits special consideration in BLM's planning and decision-making processes. Sensitive species include both the federally proposed endangered plant species (Federal Register 45 (242):82480-82569, December 15, 1980) (USDI, FWS, 1976b) and those plant species listed in the California Native Plant Society's (CNPS) "Inventory of Rare and Endangered Vascular Plants of California" (Powell, 1980).

The only sensitive species that has been documented inside the boundaries of the lease study area is Orocopia sage (Salvia greatai). This species is currently under review as a candidate for Federal listing by the U. S. Fish and Wildlife Service (1980), and is listed by the California Native Plant Society as rare and endangered (CNPS List #2). Orocopia sage is a spiny-leaved shrub with open branching. It is found along dry washes and fans below 600 feet in elevation in the Mecca Hills, Orocopia Mountains, and Chocolate Mountains, and in drainages to the Salton Sea. Within the study area, Orocopia sage occurs along a tributary of Salt Creek wash. Several other localities are documented just outside the study area boundaries along Salt Creek and near Dos Palmos Springs.

Sensitive Wildlife Species

The Yuma Clapper Rail (Rallus longirostris yumensis) is listed as endangered by the U. S. Fish and Wildlife Service (USFWS) and rare by the State of California. It is a secretive species requiring mature stands of cattails or bulrush in shallow water near high ground (Ferrier, 1976 and Smith, 1975). Within the study area there have been sightings at the Whitewater Delta, mouth of Salt Creek, deltas of the New and Alamo Rivers, Wister Wildlife Management Area, Finney-Ramer Unit, and the Salton Sea Wildlife Refuge (McCaskie, 1974, 1977; Bennett and Amhart, 1978; Jurek, 1975; and Gonzales, Wister Unit Manager, pers. comm.). At least a portion of the Yuma Clapper Rail population is resident.

The California Black Rail (Rallus jamaicensis corturniculus) is listed as rare by the State of California. There are recorded sightings at the Whitewater delta and at the mouth of Salt Creek (McCaskie 1974, 1977), and additional sightings at the Salton Sea National Wildlife Refuge and Wister Unit. There is not full agreement among investigators as to the residency status of this species (Wilbur, 1974). There are several notes in the literature noting this bird's tendency to desert nests if disturbed during the nesting season (Huey, 1916 and Heaton, 1937).

California Brown Pelicans (Pelecanus occidentalis californicus) are recorded in small numbers regularly at the Salton Sea. This group is comprised primarily of the young of that year which arrive at the Salton Sea from Mexico after the breeding season. Pelicans are generally found in open water; however, they also utilize the mudflats and shoreline for loafing. The Brown Pelican is listed as endangered by both the USFWS and the State of California.

American Peregrine Falcons (Falco peregrinus anatum), listed as endangered by both USFWS and the State of California, have been recorded several times at the Salton Sea. They are generally recorded at marshes/mudflats or cultivated fields.

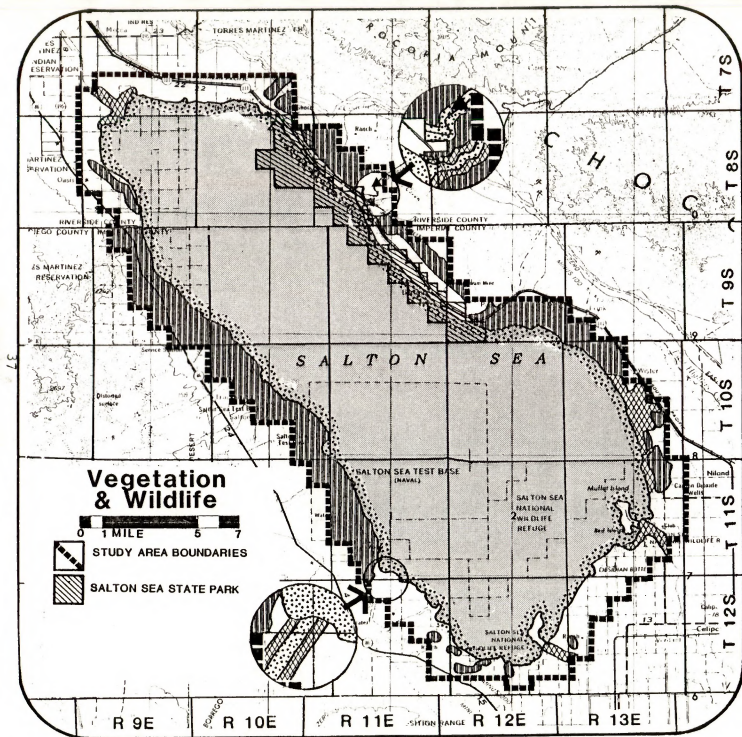
Bald Eagles (Haliaeetus leucocephalus), listed as endangered by both the USFWS and the State of California, are a rare fall and winter visitor to the Salton Sea. The study area is considered foraging and perching habitat.

California Least Terns (Sterna albifrons browni) are accidental visitors generally seen at the south end of the Sea during the summer (Dunn, 1977). Least Terns are listed as endangered by both the USFWS and State of California.

Aleutian Canada Goose (Branta canadensis leucopareia) is federally listed as endangered and is an infrequent visitor to the Salton Sea.

Desert pupfish (Cyprinodon macularis) is listed as endangered by the State of California and will soon be proposed for listing by the USFWS. Quarterly surveys in 1978 and 1979 by California Department of Fish and Game indicate that desert pupfish comprise 3% of fishes from irrigation ditches around the Salton Sea, 5% of the total from shoreline pools and less than 1% from natural tributaries and the Salton Sea proper. Two exceptions are Salt Creek and San Felipe Creek. In January 1980, two of four fish captured at Salt Creek were desert pupfish. When Salt Creek was re-trapped in May 1980, 24 of 33 fish caught were desert pupfish. Trappings at San Felipe Creek have resulted in 70-90% of the catch being desert pupfish.

The flat-tailed horned lizard (Phrynosoma m'calli) is fully protected by the California State Fish and Game Code and under status review by the USFWS. This species is uncommon, occurring in areas with sandy soils and sparse vegetation. It feeds primarily on ants, but will also eat other small invertebrates. The study area is within the range of the flat-tailed horned lizard although no optimal habitat as described by Turner, et. al. (1980), is within the study area.



Sensitivity Zones

To facilitate analysis of anticipated impacts, the ten vegetation habitats have been rated as having high, moderate, or low sensitivity (See Table 3). Criteria for sensitivity ratings are based on the following factors:

- a. Presence of listed or sensitive species
- b. Relative rarity of each habitat type within the entire California desert
- c. Diversity of plant and animal species
- d. Productivity of plant community and value as wildlife habitat

Using these criteria, three levels of sensitivity were defined for vegetation and habitat types:

High - Uncommon habitat within the CDCA

- Occurrence of listed or sensitive species
- High diversity of plant and/or animal species
- High productivity of floral and faunal communities
- High value as wildlife habitat

Moderate - Fairly common habitat within CDCA

- Supports relatively abundant and diverse flora and/or fauna
- Possible occurrence of sensitive, but non-listed species

Low - Common habitat within CDCA

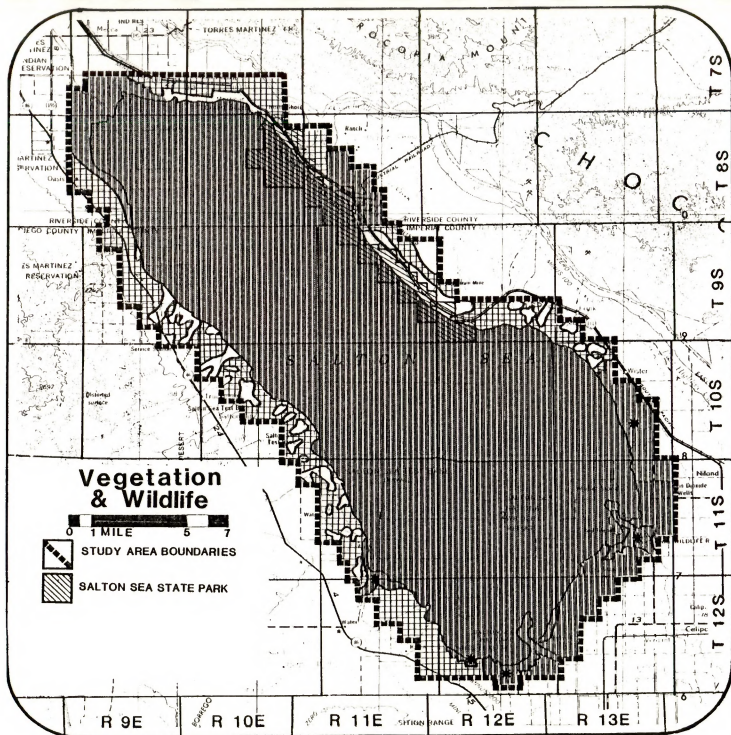
- Low diversity of plant and/or animal species
- Low productivity of floral and faunal communities
- Low value for potential wildlife habitat

TABLE 3

Habitat Types and Sensitivity Rating

Habitat	Description	Common Plants	Sensitivity Rating
Creosote Bush Scrub	Rich in annual species; most common habitat in the study area and the California Desert. This habitat may support marginal populations of flat-tailed horned lizards within the study area.	Creosote bush (<u>Larrea tridentata</u>) Burro bush (<u>Ambrosia dumosa</u>) Brittle bush (<u>Encelia farinosa</u>)	Moderate
Sandy/Low-Cover Desert Scrub	Possible habitat for flat-tailed horned lizard.	Creosote bush (<u>Larrea tridentata</u>) Wing-scale (<u>Atriplex canescens</u>)	Moderate
Desert Micro-phyll Woodland	High diversity of vegetation providing rich wildlife habitat; bird and reptile densities are often 10 to 50 times greater than adjacent creosote flats.	Ironwood (<u>Olneya tesota</u>) Palo verde (<u>Cercium floridum</u>) Cheese bush (<u>Hymenoclea salsoda</u>)	High
Riparian Woodland	Generally follows perennial or intermittent stream courses. Very diverse vegetatively and provides excellent wildlife habitat. Important area for breeding and migrating birds.	Desert willow (<u>Chilopsis linearis</u>) Mesquite (<u>Prosopis juliflora</u>) Tamarisk (<u>Tamarix pentandra</u>) Smoke Tree (<u>Dalea spinosa</u>)	High
Alkaline Sink Scrub	Relatively low plant and animal diversity. Dominant plant association along shoreline.	Allscale (<u>Atriplex polycarpa</u>) Pickleweed (<u>Allenrolfea occidentalis</u>) Chinese pusley (<u>Heliotropium curassavicum oculatum</u>) Salt grass (<u>Distichlis spicata</u>) Tamarisk (<u>Tamarix pentandra</u>)	Low

Habitat	Description	Common Plants	Sensitivity Rating
Barren	Sparse vegetation to barren, primarily annuals, low numbers and diversity of wildlife species.		Low
Freshwater Marshes	Found in association with the drainages of the Salton Sea. A unique community in the arid California desert. Provides habitat in this area for Yuma Clapper Rail and California Black Rail.	Cattails (<u>Typha domingensis</u>) Common Reed (<u>Phragmites australis</u>) American Bulrush (<u>Scirpus americanus</u>) Prairie Bulrush (<u>Scirpus paludosus</u>) Black willow (<u>Salix goodingii</u>)	High
Mudflats and Shoreline	A rare habitat in the California desert rich in invertebrates; provides valuable feeding, loafing and resting area for shorebirds.	Mexican Sprangle top (<u>Leptochloa uninerva</u>) Willow-weed (<u>Polygonum lepathifolium</u>) American Bulrush (<u>Scirpus americanus</u>) Sea-purslane (<u>Sesuvium verricosum</u>)	High
Agricultural	Important feeding areas for geese, shorebirds and wading birds. Some of the agricultural areas in the wildlife refuges in the Salton Sea are flooded on a rotating basis to provide freshwater marshes, open water habitat, and green feed crops for wildlife.	Cultivated crops The agricultural areas within the wildlife refuges have been rated as highly sensitive.	Moderate
Salton Sea	Supports viable, self-sustaining sport fishery, and high concentrations of rafting waterfowl.		High



SALTON SEA E.A.

Sensitivity



High*



Medium



Low

* State Imperial Wildlife Area & Salton Sea National Wildlife Refuge



Map 3

D. Human Values

1. Cultural Resources

Archaeology

The significant factor in the prehistory of the study area was an alteration in the Colorado River's course in about 1000 A.D. For about 450 years, much of the Colorado River runoff entered and filled the Salton Trough, thereby creating a large freshwater lake, Lake Cahuilla. During this period, people from other parts of southeastern California occupied the shoreline.

It is believed that upon a rechanneling of the Colorado River back into the Gulf of California, the lake dried up. This forced the shoreline inhabitants to move elsewhere. For more details refer to Late Prehistoric Human Ecology at Lake Cahuilla, Coachella Valley, California by Wilke (1978a).

For detailed discussions of archaeological sequences and cultural chronologies for the study area and adjoining areas refer to Background to Prehistory of the Yuha Desert Region by Weide and Barker (1974) and A Cultural Resources Overview of the Colorado Desert Planning Units by Warren et. al. (1981).

Little archaeological inventory has been carried out within the Salton Sea Study Area, resulting in an extremely scanty data base. The study area was not included in the Desert Plan inventory, nor was any inventory carried out for the current EA. Although archaeological sites may exist under the Salton Sea, the Sea itself has not been addressed in terms of archaeology. Location of underwater archaeological sites for mitigation is not possible. This report will refer only to onshore portions of the study area.

Sensitivity Ratings

The study area has been zoned into areas of high, medium, low, no, and unknown sensitivity using the following criteria.

High - Contains a rare/unique site type or assemblage of sites; or contains an unusually high site density; or potential is high, based on known environmental or other factors, for the presence of such sites or site densities.

Medium - Contains a moderate number of more common site types; or there is a fair probability of the existence of such sites.

Low - Contains few sites of common types; probability is low for any archaeological materials.

No - Because of negative inventory results or due to high levels of disturbance from development (agriculture, etc.), contains no intact archaeological materials.

Three areas of high sensitivity have been delineated, based solely upon existing site records. The first (Zone A) was inventoried in 1975 for the Department of Transportation by personnel from Imperial Valley College Museum. A linear segment was inventoried prior to road construction resulting in recordation of a number of lithic and potsherd scatters. Petroglyphs and pictographs also occur here, as well as house rings denoting occupation sites. Since only a linear segment was surveyed, it is highly probable that still unrecorded sites exist in the area. This possibility is strengthened by the fact that numerous recorded sites exist immediately outside the study area here.

A survey by Westec, Inc., in 1980, resulted in recordation of thirty clustered archaeological sites that have been designated Zone B. Although a number of those sites consist only of isolated single finds, the density of archaeological materials here is considered significant.

Obsidian Butte (Zone C) has long been known as an important obsidian quarry site for aboriginal populations. Obsidian from this source is found at many archaeological sites in the area.

Four areas of medium sensitivity have been delineated. The first of these is the vicinity of Bat Caves Buttes (Zone D) which has been reported by a Cahuilla informant as having been a habitation site, and archaeological materials here indicate that aquatic birds were exploited at this location by local native populations.

The second area (Zone E) has been rated as medium rather than high because the archaeological materials here, while highly significant, were recorded decades ago and it is questionable that the site remains intact. Cremation burials were originally reported here, along with a number of other remains.

The two remaining medium sensitivity sites, Zone F and G, were included within the Salton Sea Anomaly EA Study Area. Based on existing data and prediction these areas were given medium sensitivity ratings at that time (Westec, 1981). The rating has been retained for this report.

Zone H was sample inventoried for the Draft North Salton Sea Geothermal EA and found to contain little or no archaeological resources.

Zones I and J were rated as having "minimal sensitivity" during preparation of the Salton Sea Anomaly EA. It is important to remember that this rating was based only upon an overview of existing literature and not on actual field inventory. However, since both of these locations are in areas that have undergone a high level of disturbance, the rating has been retained.

Areas designated Zones K through N were found to have been heavily disturbed by development and agriculture (based on aerial photos) so that no intact archaeological materials are likely to remain here intact. Zone N was previously rated (Westec, 1981) as having "minimal sensitivity."

In the absence of field inventory for the current project, the archaeological potential of the remainder of the study area is unknown. Since the aerial photos used are not current, it is probable that additional areas have suffered disturbance. There is also the distinct possibility that unknown cultural resources exist within the study area, so that great care will need to be exercised, including field inventories at the plan of operations stage, to avoid undue damage to cultural resources.

Since the known sites were not inventoried, complete documentation is not available. In lieu of the necessary documentation a consideration of the sites as meeting criteria for the National Register of Historic Places is not feasible at this time. If an Application for Permit to Drill (APD) is filed, involved sites must be examined for consideration for the National Register.

Ethnography - Native American Values

The northern portion of the study area was occupied by an ethnographic group known as the Cahuilla. Their subsistence pattern involved a combination of hunting, gathering, trade, and agriculture. Both semi-permanent villages and seasonal camps were utilized. Numerous sources of information exist on the Cahuilla. Among the best are Mukat's People by Bean (1972), Studies in Cahuilla Culture by Kroeber and Hooper (reprinted 1978), Aboriginal Society in Southern California by Strong (1929), The Cahuilla Indians by Harry James (1960), Ethnobotany of the Cahuilla Indians of Southern California by Barrows (1900), and Temalpakh by Bean and Saubel (1972).

The southern portion of the study area was occupied by the Kamia. According to Kroeber (1925), there has been considerable confusion as to the ethnographic identity of the Kamia, who the Kamia really were and the full extent of their territory. Gifford, like Kroeber, considered them of Diegueño origin. "Culturally, they are intermediate between the Diegueño and the Yuma, with a heavy preponderance of traits shared with the Yuma. It is assumed that they are a people of Diegueño origin, who moved down into Imperial Valley and came under the influence of the Yuma, from whom they adopted agriculture" (Gifford, 1931). For discussion of Kamia culture, refer to Kroeber (1925), Gifford (1931), Spier (1923), and Wiede and Barker (1974).

No sensitivity map for Native American values has been produced due to the extreme lack of data and to the highly sensitive nature of this type of information. The current data base is less than adequate for prediction of site specific resources. It can be expected that some specific locations within the study area will hold sacred values for Native Americans and will not be amenable to any form of mitigation, but avoidance (Laidlaw, 1981).

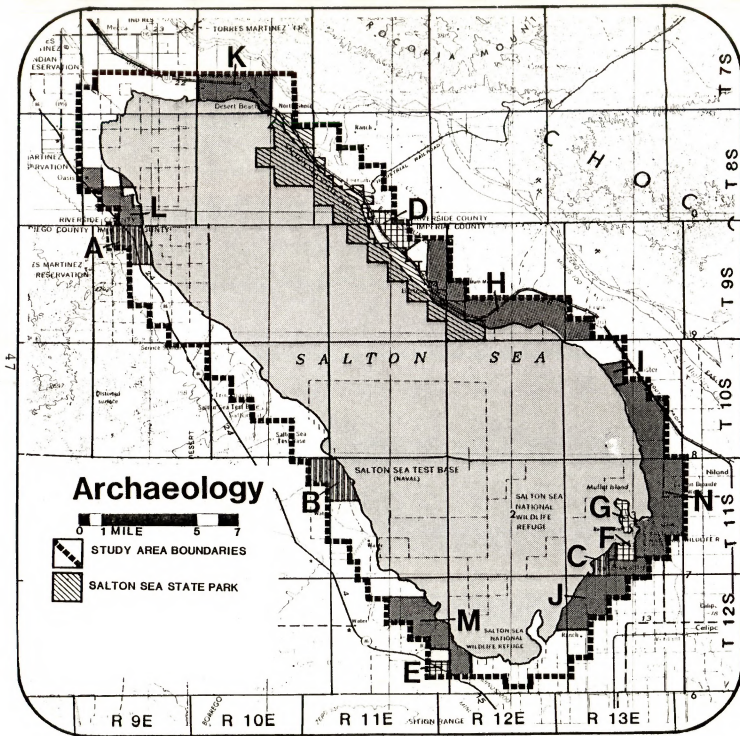
The Torres-Martinez reservation has already expressed considerable interest in the project along with specific concerns. The original reservation was established for the Torres-Martinez Band in 1876 by Executive Order with subsequent periodic additions. The reservation is laid out in a checkerboard pattern and when the Salton Sea was formed in 1905, 8,800 acres were inundated. Some members of the band have private allotments that are also under the sea. The Salton Sea has decreased the number of acres that could be advantageously used by the band.

The major concern expressed by the Torres-Martinez Band, as well as other Cahuilla Bands (Cabazon, Aqua Caliente, and Morongo) was the effect successful drilling for gas or oil on adjoining lands may have on deposits of oil or gas beneath Torres-Martinez lands.

Due to the extreme lack of ethnographic information for the study area, it will be necessary to contact relevant Native American groups/individuals at the plan of operations stage for comment. Great care should be exercised to assure that no unnecessary impacts occur to locations of significant religious/sacred value to Native Americans.

Cultural Resources
Sensitivity Summary Chart

Zone	Acres	Rating	Rationale
A	1,920	High	Thirteen recorded sites of various types; numerous sites immediately outside boundary.
B	1,920	High	Inventory here in 1980 revealed very high site density - 21 recorded sites.
C	480	High	Obsidian Butte - important obsidian quarry site for entire area.
D	1,120	Medium	Sites here associated with exploitation of lake birds when Lake Cahuilla was present. Reported by Native American informant to have been a habitation site.
E	640	Medium	Site record indicates 2-acre site containing cremations, house rings, and artifacts. Probably in a disturbed condition at this time.
F	320	Medium	This area was zoned as moderate sensitivity during preparation of the Salton Sea Anomaly Master EA, based on existing data, personal communication, etc.
G	480	Medium	Same as Zone F.
H	7,040	Low	Rated low sensitivity after inventory for North Salton Sea Geothermal EA.
I	640	Low	Rated minimal sensitivity based on data gathered for Salton Sea Anomaly EA.
J	5,120	Low	Same as Zone I.
K-N	17,607	Low/No	Aerial photos indicate that these lands have been heavily developed or are in agriculture. Zone N was also rated as having minimal sensitivity based on data collected for the Salton Sea Anomaly EA.
All Other Land Areas	49,920	Unknown	Insufficient data exists to assess the archaeological potential of these areas.
Sea	222,553	Unknown	Area is inundated.



SALTON SEA E.A.

Sensitivity



High



Medium



Low/No



Unknown



Map 4

2. Visual Resources

The most important resource of the Salton Sea, both in the active sense of use and in the passive sense of scenery, is the water - the Sea itself. It is played in, boated in, fished in, hunted from, and also is landed upon by seaplanes. It is also regarded as something restful to the eyes, something that reflects the mountains, the sky, the moon, and visually defines the floor of an expansive space, it creates an edge between itself and the surrounding land.

The Sea can be circumnavigated by auto, a 125 mile trip, and is the visual focus of a vast space (some 2,500 square miles make up the "viewshed," or visible land surrounding an observer at Salton Sea). The Sea and surrounding mountains are almost constantly visible from the highway and the lands on either side.

The proposed gas lease sites have been rated a scenic quality Class A which is the highest rating on the scale used by the BLM to determine the visual worth of an area. The landform is of low relief with broad flat rolling topography. The surrounding mountains create a spectacularly diverse background for the Salton Sea. The colorful Chocolate Mountains to the east, the rugged Orocoapias and Meccas to the north and breathtaking snowcapped Mount San Jacinto and the Santa Rosas to the west all combine to form a magnificent backdrop to the basin. Much of the beauty of the setting is contributed by these mountains and the alluvial fanslopes that connect them with the shoreline. Although many of the recreational activities that take advantage of the lake's surface, do not depend on scenic surroundings, such experiences are improved by the beauty of the setting.

At either end of the Sea there are flat agricultural areas with a characteristic NS-EW grid pattern. Most of the landowners live in valley towns or outside the county. Tall processing or storage facilities, high-density cattle feedlots, and other construction and engineering works punctuate the visual scene at irregular intervals.

Sensitivity Ratings

Nine sensitivity zones were identified within the Salton Sea Study Area. The sensitivity ratings were derived by using the following criteria:

- a. Scenic value as defined by the BLM Visual Resource Management procedures (all areas were Class A)
- b. Degree of visibility and use (distance zones)
- c. Anticipated user attitudes toward this development.

The criteria combined to yield the following sensitivity rating guidelines:

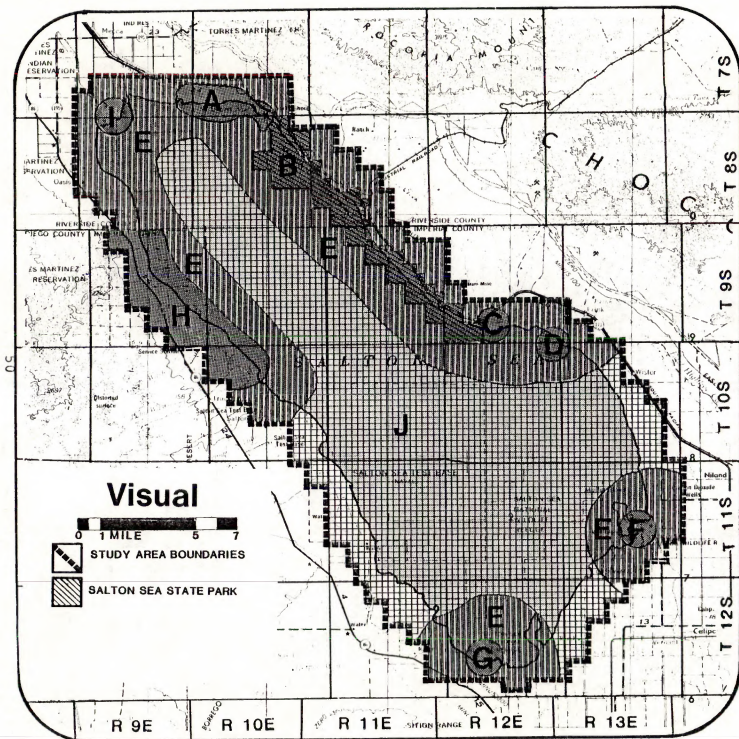
High - Areas of intermittent to sustained recreational use which have a high anticipated user attitude sensitivity.

Medium - Seldom or never used recreational areas which are adjacent to high sensitivity areas and are anticipated to have a moderate user attitude sensitivity.

Low - Areas seldom seen by users at close range.

The guidelines were applied to the study area and yielded the following sensitivity zones:

Zone	Acres	Sensitivity Rating	Notes and Rationale
A	5,120	High	Cleveland Street Drain North Shore - Adjacent land is agricultural row crops; Sea is visible from Highway 111; Expansive view.
B	16,500	High	Salton Sea State Park (including private parcels) - Arid area; Attracts large numbers of visitors.
C	640	High	Bombay Beach - Views to Superstition Hills; Permanent population of approximately 275.
D	640	High	Niland Marina.
E	57,600	Medium	Shoreline to two miles - Area of visibility from recreational use areas.
F	640	High	Red Hill Marina - Views to Obsidian Butte which is one of the most visually interesting places around the Sea. Views to Mullet Island.
G	640	High	Benson's Landing.
H	16,000	High	Salton Bay Marina and Yacht Club, Lido Palms Marina, Salton Sea Beach, and Desert Shores have approximately 3000 residents; many facilities heavily used.
I	640	High	Whitewater River Delta - Favorite of bird-watchers. Many hunting clubs.
J	211,980	Low	All other areas (center of Sea) - Low visibility, low use area.



SALTON SEA E.A.

Sensitivity



High



Medium



Low



Map 5

3. Land Use

Non-Recreational

Access

North-south access in the area is provided by Route 86, which connects the cities of El Centro, Brawley, Westmorland and Indio, and Route 111, which connects Calexico with Brawley, Calipatria, Niland and Indio. Route 86 between Brawley and El Centro is a four-lane divided expressway, as is Route 111 between Interstate 8 and Calexico. Interconnecting this overall framework is a supplemental grid-like system of county and local streets and highways.

Land Constraints

Indian Reservations: Descendants of the original Indian tribe in the Coachella Valley own alternate square-mile sections on the northern part of the Sea. The Bureau of Indian Affairs administers the Torres-Martinez Indian Reservation and has indicated its concern about reduction of land by infringement by the Sea.

Salton Sea National Wildlife Refuge: The U. S. Fish and Wildlife Service maintains the Salton Sea National Wildlife Refuge on the southeastern shore of the Salton Sea. A Master Plan for that Refuge was developed in 1971 but is now outdated largely due to the fact that the level of the Salton Sea has substantially risen. The Plan is currently being revised. Objectives of the Refuge are to: 1) provide feeding and nesting areas for wildlife; 2) preserve and maintain habitat for wildlife; 3) protect endangered and other sensitive species and their habitat; 4) develop and maintain waterfowl habitat and manage wildlife populations to prevent or reduce crop predation; and 5) provide opportunities for wildlife oriented recreation and enjoyment. In reaching these objectives, the refuge is managed to maintain cropland, marsh and open water habitat.

Imperial Wildlife Area: The Wister Waterfowl Management Area located in the southeastern portion of the study area adjacent to the Salton Sea is owned by the state and is one of three units of the Imperial Wildlife Area. Although there is no master plan for the Imperial Wildlife Area, the objectives are generally the same as for the Salton Sea National Wildlife Refuge. In addition to wildlife habitat, waterfowl hunting and camping opportunities are provided.

The California Protected Waterways Plan, published by the State of California Resources Agency, designates the Salton Sea as a Priority A, Priority Action Waterway. Waterways with this designation have the highest priority and detailed protected waterway management plans for them are to be undertaken. The plan also lists the Salton Sea marsh as one of the scenic waterways of California's landscape provinces (Desert and Desert Mountain) and as Class II - Very Good Waterways (these areas exclude Federal refuges and state-owned "wildlife" areas) (California Resources Agency, 1971).

Sensitivity ratings of the land uses mentioned above will be covered under their appropriate resource section (wildlife and cultural resources).

Recreational Land Use

The Salton Sea, a unique recreation resource, is the second lowest area in the United States (after Death Valley). The Sea is a favorite stopover for recreational travelers. It is currently the destination of about 500,000 hunters, fishermen, and others each year. But earlier, in 1967, an estimated 1,000,000 people visited the area; the decline is apparently due to the effects on fishing and boating of steadily rising water level and salinity in the Salton Sea over the last decade.

During most of the 1960s, the lake level remained stable; several recreational and residential facilities were constructed in anticipation of a stable shoreline, and up to a million people visited the Sea. In recent years, increased irrigation has created an imbalance between the supply of water to the lake and evaporation. This, combined with exceptional rains, has nearly totally inundated several of these facilities. At the present time, all control of irrigation inflow to the Salton Sea is subject to the Presidential Orders of Withdrawal of 1924 and 1928 that created a reservoir in Salton Sea for storage of waste and seepage water from irrigated land in Imperial Valley.

Four major categories of outdoor-recreational user groups can be identified in the study area: hunters and fishermen, boaters and water skiers, off-road-vehicle (ORV) enthusiasts, and retired persons. Hunting and fishing are the most significant non-desert-oriented outdoor-recreational activities in the Salton Sea area. Records of the Imperial County Parks Department show that in recent years boat launching for non-fishing purposes, such as water skiing, has comprised about 9% of the total use.

The Salton Sea offers the open land and warm winter climate desired by retired people. Several recreational communities (Salton City, Desert Shores) are scattered along the western shoreline of the Salton Sea, but resident populations have remained low. Three campgrounds with hook-ups for over a thousand campers and trailers are leased at the hot springs east of the Salton Sea.

Although these areas seem to be the principal facilities available to permanent retired residents and to winter visitors, the populations at these resort communities are not a good indication of the actual number of retired persons in the valley. Not all of the residents are retired, and a large, uncounted number of retired visitors camp in the desert and along the irrigation canals. An area known locally as Slab City, east of Niland, attracts the largest number of these people. Originally a military installation and later an internment camp, the area was cleared of buildings and

all that is left are the concrete foundations of barracks - the "slabs" - and remnants of roads. No census has been taken of people camped there. Interviews with local recreation-area managers indicated that, at peak use in January, Slab City has a population of several thousand. Dances are organized, and a sign welcomes visitors to the area in the off-season.

Number of Visitor Use Days*
In the Salton Sea Area
July 1980 - June 1981

Area	Hunters	Fishermen	Other	Total
Salton Sea National Wildlife Area	3,898	720	11,078	15,696
Imperial Wildlife Area	9,664	30,502	14,704	54,870
Imperial County Parks	1,500	18,000	6,000	25,500
Salton Sea State Recreation Area	--	201,928	134,618	336,546
Private Campgrounds and/or Marinas - estimate	--	130,128	115,442	245,570
Non-controlled Areas	39,900	912,000	20,000	971,900
Private Duck Clubs	17,835	--	--	17,835
Totals	72,797	1,293,278	301,842	1,667,917
Percentage	4.5%	77.5%	18%	

Additional Factors:

1. Sightseeing and short term day use activity attendance figures for most marinas/RV parks were not available and are not included.
2. Attendance figures for the new West Shore launching facility and some smaller private operations were not available and are not included.
3. Visitor use attendance figures for the Salton Sea National Wildlife Area were negatively influenced by considerable repair and construction work being performed on the dikes. Normal visitor use is higher.
4. Attendance figures for the Salton Sea State Recreation Area are not actually visitor use days because of the method used to determine overnight use. Visitor use days are approximately 10% higher.

* Most resident use days not included

Notes: Other is defined as

Camping - not fishing or hunting
Boating - not fishing or hunting
Bird watching/Nature study
Sightseeing
Off-road vehicle activity

Visitor Attendance
Salton Sea State Recreation Area

Year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
1974-75	11,312	15,294	15,299	15,644	28,944	9,152	10,735	14,989	29,329	24,306	30,941	12,279	228,204
1975-76	8,200	9,937	8,775	15,748	15,677	8,153	12,194	12,991	11,786	32,271	26,202	12,222	174,156
1976-77	14,616	13,194	12,010	21,011	20,678	9,496	10,352	20,102	13,738	35,454	34,049	18,554	221,454
1977-78	11,558	8,137	15,076	19,096	24,474	9,501	11,305	16,043	21,235	29,666	30,270	10,788	207,149
1978-79	11,082	8,533	12,915	17,201	22,177	8,761	10,269	18,724	22,811	40,972	24,815	15,691	213,953
1979-80	12,438	12,271	10,987	15,089	18,812	9,985	9,477	13,507	20,635	34,185	30,931	20,418	288,816
1980-81	12,522	15,744	15,524	20,570	27,602	17,103	28,560	34,897	31,859	55,704	50,368	25,593	336,546
1981-82	23,808	17,815	18,879	26,263	27,214	19,248	24,165	39,029					

Hunting is a popular form of recreation throughout the Imperial Valley. The California Department of Fish and Game conducted a study of the area between the Coachella Canal and Highline Canal from the All-American Canal to Wister. Data indicated that dove and quail hunting were the most popular, and the best hunting for dove and quail was in agricultural land habitats. The estimates of county-wide hunting use reported by the Department of Fish and Game show that dove hunting is three times more popular than the next most popular game.

Public hunting is permitted in season for waterfowl, Wilson snipe, cottontail and jack rabbits, Gambel's quail, and dove. Upland game hunting is not permitted in the Wister unit during waterfowl season, however. Permits for both the Wister Unit and the Salton Sea National Wildlife Refuge (SSNWR) are regulated from the Wister Unit check station. Hunting is allowed three days a week during hunting season with a maximum of 200 hunters per day at the Wister Unit and the SSNWR combined. A total of 5,170 acres were open to public hunting at the combined Wister and SSNWR areas. Of these, 850 acres were in green barley or annual rye grass for goose hunting. Hunter use at the Wister Unit for the 1974-75 and 1975-76 seasons show little change. Fishing and nonconsumptive recreation also occurs at the Wister Unit.

The Salton Sea is also an outdoor laboratory for many scientists and educational institutions in Southern California.

Sensitivity Zones

Fifteen sensitivity zones were identified within the Salton Sea Study Area. The sensitivity zones were rated using the following criteria:

High - Areas with a sustained level of recreational use.

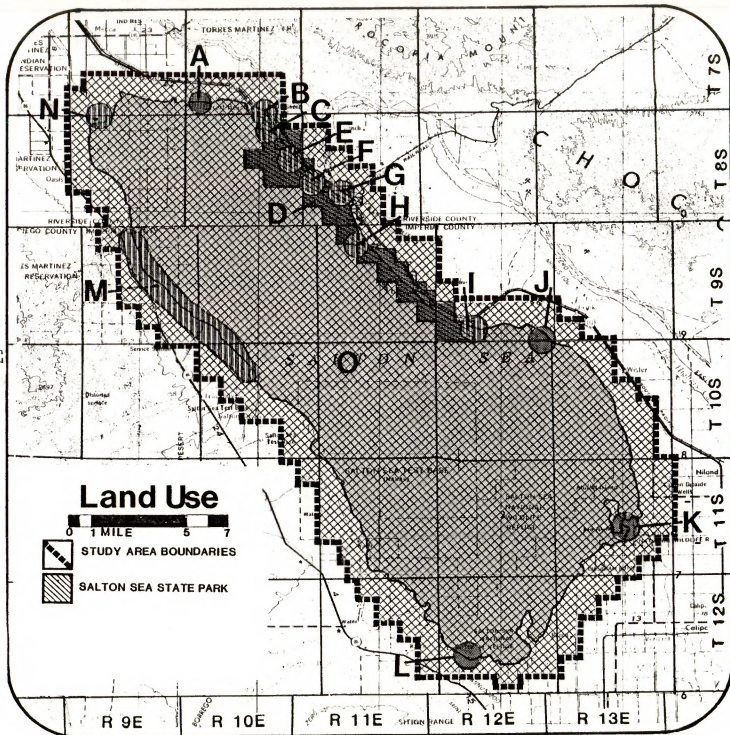
Medium - Areas with intermittent recreational use. This includes areas previously heavily used but now inundated by floodwaters.

Low - Seldom or never used recreational areas or areas with little or no potential for recreational use.

The above criteria have been used to zone the area into High, Medium and Low Sensitivity for the purpose of analysis.

Zone	Acres	Rating	Rationale and Notes
A	640	Medium	Cleveland Street Drain - Excellent, well used fishing area.
B	640	High	North Shore - Resort area with motel.
C	1,280	High	Salton Sea State Park Headquarters - Visitor center, 50 developed campsites, 120 person group camp.
D	15,000	Medium	Salton Sea State Park - All undeveloped areas.
E	640	High	Mecca Beach - Developed campground (140 sites).
F	640	High	Corvina Beach - Primitive campground.
G	640	High	Salt Creek - Primitive campground.
H	640	High	Al and Chris and Bob's Playa Riviera.
I	640	High	Bombay Beach - Boat launching marina (100 boats) and trailer park (80 units). Permanent population of approximately 275 people.
J	640	Medium	Niland Marina - Once popular county run launching facility and boat basin with accommodations for 120 campers, small store and gas station on Highway 111. Now flooded and nearly deserted.
K*	640	Medium	Red Hill Marina - County run park reduced due to flooding to five picnic sites, restroom and 52 trailer/camper spots.
L*	640	Medium	Benson's Landing - Boat launching.
M	16,000	High	Salton Bay Marina and Yacht Club, Lido Palms Marina, Salton Sea Beach, and Desert Shores have approximately 3000 residents. Boat launching, trailer park, golf course, landing strip, camping, picnicking, motel, restaurants and assorted commercial establishments.
N	640	High	Whitewater River Delta - Hunting clubs and favorite birdwatching area.
O	270,440	Low	All other areas - Low or no recreational use or potential.

*Note the southern half of the Salton Sea is generally not used for recreation due to poor water quality which results in fish kills that create unpleasant odors.



SALTON SEA E.A.

Sensitivity



High



Medium



Low



Map 6

4. Socio-Economics

Population Characteristics

The study area is located in Imperial and Riverside Counties. Historically, the study area and surrounding valley communities had experienced a net loss in population between 1930 and 1970 as a result of 1) increasing mechanization of agriculture, which in the several decades has led to decreasing manpower requirements; and 2) greater and more diverse employment opportunities in outside areas which have attracted many job-seeking persons, primarily young adults away from the area. However, examination of components of population change in Imperial County between 1970 and 1980 indicate a reversal in the previously recorded migration pattern. 9,300 persons migrated to Imperial County between 1970 and 1980 to become new residents. This shift is generally consistent with U. S. Census findings indicating a nationwide shift to non-metropolitan areas.

On the west side of the Sea is Salton City, the largest of several recreational communities and typical of the type community in the area.

Salton City is an unincorporated development with approximately 1700 permanent residents. There are 20,000 individually owned lots in a 21 square mile area that are served with water lines and partial sewers. There is a school, golf course and a few stores. The city fronts on the Salton Sea and its residents are primarily retired persons.

Community Attitudes

Community attitudes in Imperial County in response to a questionnaire concerning development of geothermal development in 1977 indicated that 90% were in favor of geothermal development because of the expectation that geothermal energy would increase jobs; attract new businesses; provide a cheaper and more available future power supply and other related benefits. Twenty-one percent of those surveyed foresaw environmental or social problems arising out of geothermal development.

Although community attitude studies have not been conducted specifically for the study area, community concerns regarding potentially adverse impacts to the Salton Sea are very prevalent. The Salton Sea Fish and Wildlife Club with approximately 350 members was formed in December 1980 for the purpose of protecting the Salton Sea environment.

Employment

The two basic industries in the local area are agriculture and activities related to recreation. There is only limited crop acreage within the boundaries of the shoreline area itself. Immediately to the north and south, however, lie the Coachella and Imperial Valleys, together containing more than a half-million acres of irrigated cropland. Important crops are grains, fruits and vegetable produce, seed crops, and livestock. These two areas provide the bulk of agricultural production in Imperial and Riverside counties, with a total FOB value of all products exceeding \$434 million in 1967. Imperial County alone lists fourteen separate crops with market values exceeding \$1 million in 1967.

While agriculture continues as an important part of the local economic base, it has in recent years seen its once unique position challenged by a growing sector of economic activity based on recreational and residential development. Recreational use of the Sea is currently in the neighborhood of 1.5 million recreation-days annually, and over \$140 million are estimated to be invested in public and private facilities around the Sea. Both the spending done by recreationists and the physical investments in the local area are in a sense measurable economic effects of this recreation use.

A significant potential source of local industry is found in the geothermal wells located to the south and east of the Sea. A report on the Salton Sea geothermal field has been prepared by the Division of Mines and Geology, State of California, as a part of this Reconnaissance Investigation. The economic benefits from these geothermal wells include minerals, electric power, and pure water.

The unemployment rate fluctuates on a seasonal basis and accordingly is lowest during the winter harvest months and highest during the summer months. Even at its lowest point, the area's unemployment rate historically has exceeded both the state and national unemployment percentages.

The sensitivity of the area is a factor of many other resource concerns (visual, land use (recreation), and wildlife) and will be designated under each of these categories.

For additional data reference: The North Salton Sea Geothermal EAR, 1978; Westec Magma Geothermal EIS, 1981, Economic Benefits Derived from the Waters of and Lands Surrounding the Salton Sea and Potential Impacts of Geothermal Development on Outdoor Recreation Use of the Salton Sea, 1980.

IV. Environmental Impacts of the Proposed Action and Alternatives

A. Introduction

This chapter describes the unmitigated impacts which could result from implementation of the proposed action and alternatives. The impact assessment which follows provides the basis for development of mitigation measures as defined in Chapter V.

Assessment of impacts were derived by using the following system:

Specialists took the sensitivity zones defined in Chapter III and combined them with the anticipated level of disturbance to come up with the environmental impacts for their resources. The following matrix was used:

TABLE 4

		LEVEL OF DISTURBANCE			
		High*	Med**	Low***	No
SENSITIVITY ZONES	High	H	H	M	No
	Medium	H	M	L	No
	Low	M	L	L	No

} Environ-
mental
Impacts

Level of Disturbance

- *High
- The resource value is destroyed in total; or
 - Damage is so extensive that the values will not recover in a lifetime (60 years).
- **Medium
- Heavily damaged (values are negated) but loss will heal in less than a lifetime (60 years); or
 - Moderate damage (half the values intact) to the resource that diminishes quality but will not recover in a lifetime (60 years).
- ***Low
- Moderate damage (half the values intact) to the resource that diminishes quality but will recover in a lifetime (60 years); or
 - Small portions of the values are significantly diminished or lost and will not recover in a lifetime (60 years). Most values are intact.

The anticipated impacts are defined graphically on maps at the end of each section. In addition, a summary chart is provided to show level of impacts by zone.

B. Non-living Components

1. Geology

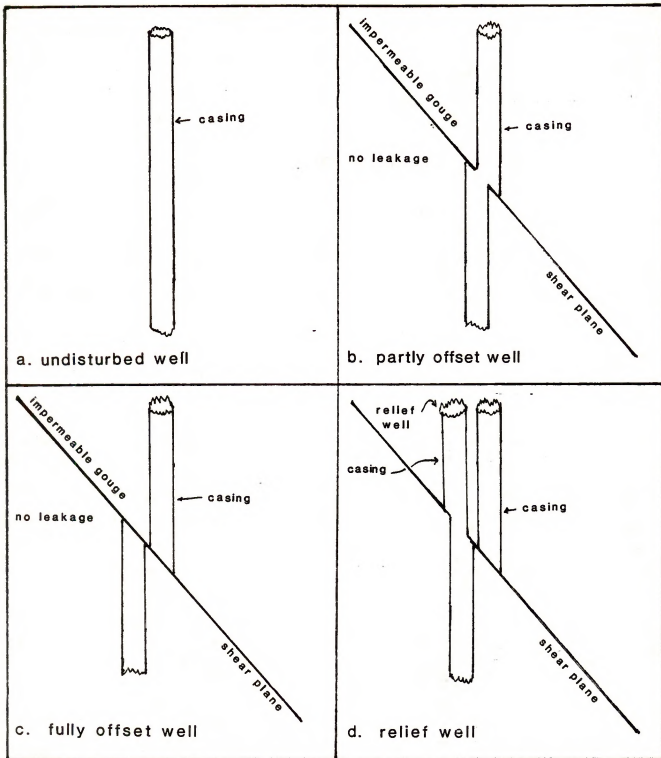
No negative geologic impacts are anticipated. Additional geologic and geotechnical knowledge gained during exploration and development would be a highly positive impact.

Like any building or facility, oil and gas exploration, production and equipment, if not of an appropriate design, may be susceptible to damage from shaking, shear, or liquefaction in an earthquake. However, where designed to resist the effects of earthquakes, drill rigs, ancillary facilities, and pipelines have a good record (A. Clifton, USGS offshore, pers. comm., 1981). Recent studies cited by Woodhall (1980), for offshore earthquakes, indicate that the resulting forces are less in marine sediments than on land. Whether this conclusion is valid in the Salton Sea is conjectural. Earthquake damage to wells and surface facilities is considered highly improbable, considering the record of similar equipment at Brawley and East Mesa, and the good record of such equipment elsewhere.

During exploration or production, a well could be offset by subsurface fault movement or accompanying shear. While highly unlikely, the motion could damage the well casing, and cause a leak or blowout (see Figure 4-1). Fault or shear planes, where offset could occur, are often found during geophysical exploration. In the highly improbable event that a blowout were to occur along such a plane, the surface expression would probably be away from the wellhead. However, the impermeable nature of the fine, naturally-occurring, clay-like gouge found within these planes acts as a seal, effectively cuts off the well, or prevents leaks. Any damage to a well caused by fault movement or shearing is considered to be highly improbable, as evidenced by the integrity of the geothermal wells at East Mesa during the earthquake of October, 1979.

Geology Impact Summary

Zone	Acres	Impact Level	Notes
Total Study Area	309,760	No	No impacts anticipated



- (a) This frame shows a section of undisturbed well.
- (b) This frame shows a partly offset well. Impermeable clay-like gouge prevents leakage by sealing off break in casing. Gouge occurs naturally in shear plane.
- (c) This frame shows a totally offset well. Impermeable clay-like gouge prevents leakage by completely sealing off well. Gouge occurs naturally in shear plane.
- (d) This frame shows a relief well drilled to relieve pressure (in the highly improbable event of leakage). Well and leakage are sealed by pumping cement down the relief well. This permanently seals the well.

2. Water Resources

The California Regional Water Quality Control Board (CRWQCB) prohibits any waste materials from entering the Salton Sea, and requires all wastes to be discharged at an approved disposal site.

Prior to drilling an exploratory well, the applicant is required by the CRWQCB to submit a Report of Waste Discharge for prescription of Waste Discharge Requirements. Requirements are issued to protect Water Quality from the discharge of drilling muds, cuttings, clean-out fluids and other wastes.

Pollution from a producing gas field will be minimal. Gas from leaks that might occur will rise to the surface and dissipate. There is no data to indicate that the addition of minor amounts of natural gas (as would occur from a leak) would cause harm to the water quality. H₂S, however, is sometimes found as an impurity in natural gas and is toxic to fish and wildlife. Because of the insignificant nature of the anticipated changes to water quality, impacts have been assessed as low to no adverse impacts.

Water Resources Impact Summary

Zone	Acres	Impact Level	Notes
Total Study Area	309,760	Low/No	No anticipated impacts

3. Air Quality

Impacts to air quality are anticipated in varying degrees during all three phases. The data for quantifying the degree is not available. It is anticipated that emissions during the exploratory phase would be relatively small and result from power generating equipment used for drilling and vehicles. During the production phase, carbon monoxide, hydrocarbons, nitrogen oxides, sulfur dioxide, and hydrogen sulfide may be produced during routine operations. Accidents such as fire, blowouts, oil spills and leaks can also present serious air pollution problems. Hydrogen sulfide is a common by-product of gas operations. The hydrogen sulfide must be separated out and burned. This could present a source of air pollution and odor.

During the production and abandonment stages the main source of suspended particulates would be vehicle travel on unpaved roads. Unpaved roads with no gravel generate approximately 11 pounds of dust per vehicle-mile traveled. Gravel roads generate about five pounds of dust per vehicle-mile. The total number of vehicle-miles cannot be estimated at this time as it would vary with the degree of development.

The abandonment phase would have less emissions.

Air Quality Impact Summary

Zone	Acres	Impact Level	Notes
Total Study Area	309,760	Medium	Due to emissions produced by equipment and due to dust caused by vehicle movement.

4. Climatology

The lease of the Salton Sea for production of gas is not anticipated to impact the climate on a regional basis.

Climatology Impact Summary

Zone	Acres	Impact Level	Notes
Total Study Area	309,760	No	No anticipated impacts

C. Living Components

Vegetation and Wildlife

Impacts to vegetation and wildlife will occur during all phases of gas development. Major impacts include:

- Direct loss of habitat due to surface disturbance during construction of roads, parking lots, drill pads, sumps, wells, and plant sites.
- Damage or destruction to vegetation and disturbance of soil during off-road vehicle activity associated with initial exploration.
- Possible decline in vigor of vegetation if disturbances reduce availability of water or nutrients to plants.
- Degradation of habitat because of increased human presence and noise.
- Increase in turbidity and possible local increase in ammonia and hydrogen sulfide due to bottom-disturbing activities in the Sea.
- Changes in water movement due to structures built in the Sea.
- Drilling muds, cuttings, and formation waters could be spilled during an accident or blowout. Depending on the quality and chemical composition of the gas lost, hydrocarbons could be emitted during a blowout. A resulting fire could damage nearby habitat.

The ten habitat types defined in Chapter III have been combined into three sensitivity zones to facilitate impact analysis. These habitats have been grouped as follows:

	Sensitivity Zones		
	High	Medium	Low
1. Creosote Bush Scrub		X	
2. Sandy/Low-Cover Desert Scrub		X	
3. Desert Microphyll Woodland	X		
4. Riparian Woodland	X		
5. Alkaline Sink Scrub			X
6. Freshwater Marsh	X		
7. Mudflats	X		
8. Agriculture		X	
9. Barren			X
10. Salton Sea	X		

Preliminary Investigations - Onshore

Onshore, the truck mounted vibroseis unit will have negligible impact if it remains on existing roads. However, due to its size and weight, any work done off road will result in habitat disturbance.

The impacts of off road vehicle use on desert vegetation have been discussed and documented by Davidson (1973), Gibson (1973), Keefe and Berry (1973), Davidson and Fox (1974), Luckenbach (1975), and Stebbins (1974). Their studies show that ORV use: (1) reduces shrub density; (2) reduces the canopy cover of individual shrubs; (3) reduces the diversity of shrub species by selectively impacting the smaller, more fragile species; (4) reduces the diversity of both annual and perennial herbaceous species; (5) reduces the numbers of annual wildflowers that will germinate and flower in following years; and (6) increases the density of weedy species.

Off road vehicle use also causes indirect impacts to vegetation by impairing plant growth as a result of increased dust, degradation of soil biota, soil compaction and increased erosion. Soil compaction is the most serious and longlasting of these secondary impacts. Compaction can reduce or eliminate plant growth by (1) damaging seedbeds; (2) preventing water infiltration into the soil; (3) inhibiting root penetration into the soil and (4) reducing successful shoot emergence from soil. The greater the degree of compaction, the longer the period required for habitat recovery. Increased runoff from compacted soil can stimulate soil erosion, degrading habitat for established vegetation and hindering the establishment of new plants.

Preliminary investigation activities conducted near freshwater marshes could result in the temporary abandonment of the area by either the Yuma Clapper Rail or California Black Rail. This could be particularly damaging during the breeding season, generally occurring in April through June.

Preliminary Investigations - Offshore

Impacts from preliminary offshore exploration is expected to be minimal. The use of modern non-explosive energy sources for seismic surveys during the exploratory phase should have no impact on the fish of the Salton Sea.

Exploration - Onshore

The major impact resulting from exploration activities onshore will be the loss of habitat due to the construction of access roads and drilling platforms. There will also be an increase in noise and human presence. In the unlikely event of a blowout, drill muds, cuttings, and possibly formation water will be scattered in the immediate area. Gas will escape at an undetermined rate and there may be a resulting fire.

It is expected that a maximum of 20 acres would be cleared onshore for well sites plus an additional 4-10 miles of access roads. The degree of impact is wholly dependent on the location of these sites and the sensitivity of the habitats involved. Marsh habitats are extremely sensitive to disturbance due to their productivity, species diversity, and

associated listed species (Yuma Clapper Rail and California Black Rail). Construction of any kind within these areas would result in the temporary or permanent loss of habitat for these rails. Because of the secretive nature of both of these rails even adjacent construction activities with increased noise and human presence could seriously degrade the suitability of the habitat for rails, resulting in abandonment.

Freshwater inlets, shoreline pools, mudflats, riparian areas, and microphyll woodland are all very productive areas with sensitive species. Construction in any of these areas would result in a high level of impact. Alteration of freshwater inlets or shoreline pools could result in a direct loss of desert pupfish and desert pupfish habitat. There would also be a loss of potential threadfin shad and possibly corvina spawning areas. A loss of mudflats would reduce the feeding area for the thousands of shorebirds utilizing the sea. Loss of riparian areas and microphyll woodland would result in a reduction of local diversity and productivity and reduce the area available for migrating passerines.

The impact of construction in other onshore habitats with sensitivity ratings of moderate or low will be moderate to low on a regional basis. In addition to direct removal of vegetation, construction of new roads may increase access within an area to recreational vehicles. Use of desert areas by vehicles can modify species composition and reduce cover and diversity of shrub species and annual wildflowers (see North Salton Sea EA for documentation). Disturbance of vegetation in Creosote Bush Scrub habitat during construction of roads or pipelines may require 25-40 years to recover to predisturbance levels (Vasek, et. al., 1975). In areas of low productivity, such as Low Cover Desert Scrub and Barren areas, recovery of vegetation after disturbance may require more than 40 years (Clark, 1979).

Although a gas blowout is unlikely, the majority occur during exploration (Marine Board, National Research Council, 1981). As with construction, the level of impact is dependent on the habitat(s) affected. Cuttings and drilling muds would be ejected into the surrounding area. In most cases, these would be contained on the already disturbed drill site. If formation water was struck, a high saline content could sterilize affected soils and reduce plant vigor and productivity.

In addition to those impacts discussed above, a blowout near the Salton Sea or drainages could result in the contamination of the local aquatic system by cuttings, drilling muds, or formation water. These impacts will be discussed under Exploration-Offshore.

Exploration - Offshore

The major impacts from offshore drilling would be increased turbidity, possible increase in hydrogen sulfide and ammonia, changes in the water circulation pattern and the possibility of contamination by toxic materials during an accident or blowout.

There are several alternative methods for drilling offshore. Some, including the construction of islands and causeways, would probably require dredging. Besides the physical disturbance and increased turbidity, dredging also resuspends organic materials and disperses sediment contaminants through the water column.

The physical disruption of the bottom sediments will result in the direct loss of local sedentary invertebrates. The greatest loss to the Salton Sea ecosystem would probably occur when Neanthes are most restricted, during the summer at depths between 15 and 25 feet. Neanthes would probably not recolonize the foundations of islands and causeways at the same level as predisturbance because of the lowered organic content. If rock is used as fill, the area would probably be colonized fairly quickly by barnacles. Most fish would be displaced, however, some territorial fish including Tilapia and some juvenile fish could be lost.

The time required for recolonization by invertebrates after burial by drilling mud or cuttings would be dependent on the depth of the deposition, time of year, location and composition of the material deposited. Impacts would probably be greatest during the summer months at depths between 15 and 25 feet. Depths greater than 25 feet are not fully utilized during the summer because of periodic anaerobic conditions and impacts would probably be less in these areas.

Dredging and other sediment disturbing activities could result in toxic conditions if bottom muds containing hydrogen sulfide or ammonia are disturbed. These compounds are extremely toxic to fish and invertebrates and could result in local fish kills if brought to the surface. Hydrogen sulfide and ammonia are most prevalent in the bottom muds during the summer. A complete analysis of the Salton Sea sediments has not been done and sediment analysis will be necessary to determine the levels of heavy metals and pesticides in the bottom muds. In most cases, these chemicals are less available than in their free state. However, this is highly variable depending on the state of the chemical and varies with each sediment and organism (Westec, Salton Sea Anomaly Master EIR).

Impacts from increased turbidity are likely to vary with the degree of turbidity. Fish are likely to be attracted to the area, particularly the fringe areas, because of the cascading materials and the increase in suspended organic material. Areas where turbidity is above tolerance levels will be avoided by mobile fish. There may be some loss of territorial and larval fishes.

The resuspension of organic materials may prompt an algae bloom, possibly creating anaerobic conditions. This would have the greatest impact in the summer when deeper waters periodically become anaerobic.

The construction of islands would result in increased shoreline habitat and potential loafing and nesting areas for water birds, however, their full potential would not be realized until the area was abandoned. Causeways could alter the water circulation and could result in "dead" areas with high hydrogen sulfide levels, low oxygen, and increased sedimentation. Piers could be built without dredging. This would result in short term impacts from increased turbidity. The installation of barges would result in minimal bottom disturbance.

Drilling mud, cuttings, formation liquids, and other waste could enter the aquatic system intentionally or accidentally. These materials can impact the aquatic environment either through direct burial of bottom organisms, toxicity of mud components or contaminants including trace metals, biocides and petroleum hydrocarbons, through changes in the physical quality of the bottom substrate and increased turbidity (Dames and Moore, 1981).

The level of toxicity of drilling muds and cuttings has been well documented in offshore drilling operations (Dames and Moore, 1981; Neff, 1981; and Marine Board, National Research Council, 1981). It is generally felt that the periodic discharge of water-based drilling muds and cuttings into a marine environment has minimal environmental impact. However, these studies were conducted with an offshore perspective where wave and tidal action allow for vertical and horizontal dispersion. Contaminants are also dispersed over a large area offshore, lowering toxicity. The Salton Sea is a closed system with no discernible tidal action and poorly understood currents. Impacts probably would be magnified. Generally a dilution rate of 20,000 to 1 will render even the most toxic drilling mud used non-toxic. Studies done by Ecomar, 1978 and Ayers, et. al., 1980, found this dilution rate was reached between 74 and 500 meters down current in three offshore situations. Without comprehensive data on the currents in the sea and locations of discharges, predictions of the dispersal and dilution rates of drilling muds and cuttings cannot be made.

The heavy metals associated with used drilling muds have a very limited bio-availability to marine animals (Neff, 1981). The assimilation of heavy metals by test organisms has not been directly correlated with disposal operations or with the total concentration of heavy metals. However, this can be very variable. There is no current information on the sediment contaminants in the Salton Sea including heavy metals. The cumulative impacts of additional contaminants is not known.

There has been very little research done on the environmental impacts of a gas blowout (Marine Board National Research Council, 1981). This is partially due to the fact that the occurrence of blowouts is very low, especially with the high technology blowout prevention equipment in use today. The California Division of Oil and Gas oversaw 24,793 wells drilled for both oil and gas between 1970-1980. Six blowouts were experienced or 0.024% of the total. Approximately 12 were experienced during production including accidents such as tractors running into existing wellheads. The following impacts address this unlikely worst case scenario.

During a blowout, the drilling mud and cuttings are ejected from the well. Formation water, if present, can also be ejected. Natural gas bubbles to the surface and dissipates. Fires can result. The loss of drilling muds and cuttings into the sea are discussed above. Studies have shown that the deposition of these materials in offshore situations has no significant environmental impacts. Impacts in the Salton Sea could be magnified. Information on present levels of sediment contamination and water current patterns is needed to accurately assess impacts in the Sea.

Saline formation waters could severely impact the area. The Salton Sea has experienced increasing levels of salinity since its beginning. Present levels are approximately 38 ppt. Saline formation water could adversely affect local invertebrates and larval fishes. Fish would generally avoid intolerable situations. Salinity levels would have to reach 40 ppt before larval fish and eggs would be affected. Major impacts to fish are expected between 44-46 ppt.

Natural gas rising through the water column should have minimal impacts on water quality. Methane, butane, and propane, the major components of natural gas are essentially insoluble (Newman, University of California, Riverside, Chemistry Department, pers. comm.) However, hydrogen sulfide, which may be found as an impurity in gas, is highly toxic to fish and wildlife.

There is some possibility of liquid hydrocarbons contaminating the gas. Levels are expected to be very low, however, the exact chemical composition will not be known until the gas target is struck. An oily film around a blowout could occur. In a study done at a gas blowout offshore, light liquid hydrocarbons were measured in the part-per-billion range at the blowout location. These concentrations have not been shown to have observable effects on marine organisms. Light liquid hydrocarbons were quick to dissolve and within a few hundred feet of the blowout concentration levels were in the part-per-trillion range. (Brooks and Bernard, 1977.) Gas blowouts, however, have not been extensively studied and the chemical composition of this target is unknown.

Offshore activities will also create disturbance of waterfowl and fish because of noise and human disturbance. During drilling operations, the area immediately around the platform will probably be avoided. The drilling platforms are well lighted at night to accommodate 24 hour drilling and should pose no problem for low flying birds.

The submerged portion of the platforms will probably be quickly covered with barnacles. The structures may serve as an attractant to fish, due to their semi-permanent nature and may act as an artificial reef diversifying the local community (Carlish, 1964).

Offshore exploration activities will require onshore support facilities, such as roads, parking lots, offices, and living quarters. Impacts from these support facilities are addressed under the Exploration - Onshore Section.

Production - Onshore

The impacts from onshore construction of support facilities are wholly dependent on the habitats involved. Major impacts are possible including the loss of habitat of listed species. Critical habitats have been discussed under the Affected Environment and Exploration - Onshore Section. Low to moderate impacts are expected in other habitats.

Powerline construction will result in direct loss of vegetation under powerpoles, and will cause temporary damage to vegetation between poles due to trampling by work crews. Recovery from powerline construction may

occur as quickly as 30-40 years in areas of high productivity (Vasek, et. al., 1975) or may require hundreds of years in areas of very low productivity. Raptors and low flying waterfowl may be impacted by the construction of powerlines. Certain powerpole designs make the electrocution of large raptors possible during takeoff or landing. The placement of powerlines within well used flight corridors such as the area between Wister Unit and Unit J of the Salton Sea National Wildlife Refuge could result in significant losses of birds due to collision.

Pipeline construction has the potential of causing low to high impacts on vegetation. If pipelines are constructed on the surface, low to moderate impacts may result from trampling and crushing of vegetation, but this disturbance should be only temporary. However, if pipelines are buried (as to reduce visual impacts), long-term changes could occur in soil and vegetation productivity and diversity (Clark, 1979).

Production - Offshore

The laying of pipelines offshore will increase local turbidity and involves the same problems of sediment disturbance discussed under the Exploration - Offshore Section. Barnacles are likely to quickly colonize any exposed hard surface.

Artificial islands or causeways constructed may be utilized during development by gulls, terns, pelicans, and other birds, especially if disturbance is kept to a minimum.

Abandonment

Rehabilitation and restoration of the vegetation after completion of the project will be difficult. The majority of desert shrubs are extremely slow in recovering from disturbance in a damaged area. Creosote, one of the slowest growing species, may require centuries to reach the size of nearby shrubs (Vasek et. al., 1975). In areas where the topsoil is removed, revegetation may be impossible. Accidental sterilization of soil by saline formation water may retard or prevent regrowth of vegetation. Mud sumps and other waste disposal sites, because of residual contaminants, may not support vegetation. The value of these areas for wildlife habitat will be reduced.

During offshore abandonment there will be an increase in local turbidity and some sediment disturbance as wells are capped off, but this should be minimal.

Impacts to Sensitive Plant Species

Only one sensitive plant species is known to occur within the lease area. This species, Orocopia Sage (*Salvia greatai*), will be subject to the general impacts discussed earlier. Direct impacts will primarily be physical destruction as a result of being crushed or uprooted. Indirect impacts include (a) impairment of plant growth due to soil compaction and increased dust, (b) destruction of seedbeds due to soil compaction, (c) possible injury and impairment of growth as a result of accidental exposure to saline formation water, and (d) competition for habitat from introduced weedy species in disturbed areas. Adverse impacts to local populations could create a need for future listing of this currently proposed candidate for Federal listing.

Impacts to Sensitive Wildlife Species

- Yuma Clapper Rail could be affected by both onshore and offshore development. Construction activities in marshes would result in a loss of habitat. Construction near rail habitat could force rails to abandon the area. If the marsh habitat remains intact, rails may invade the area. Blowouts or accidental spills of formation liquids could contaminate nearby drainages, affecting critical food sources. Avoidance would greatly reduce potential impacts.
- California Black Rail utilizes essentially the same habitat as the Yuma Clapper Rail and is susceptible to the same impacts.
- Brown Pelican would be affected by the general impacts discussed in this report, however, no specific impacts are expected because of the relatively few numbers involved and their ability to avoid impacted areas.
- Southern Bald Eagle - same as Brown Pelican.
- Peregrine Falcon - same as Brown Pelican.
- Least Tern - same as Brown Pelican.
- Aleutian Goose - same as Brown Pelican.
- Desert pupfish populations would be seriously affected by both onshore and offshore development. Because of the very limited distribution of this species, even the loss of small areas would be significant. San Felipe Creek was considered the most viable population of desert pupfish in California by California Department of Fish and Game (Glen Black, 1980). Salt Creek was trapped by Black later in 1980, and good pupfish populations were found. The best habitat in Salt Creek is outside of the study area, however, pupfish do occur throughout Salt Creek. Pupfish in shoreline pools are very vulnerable to localized impacts. A current map of shoreline pools is not available. An accurate map will be necessary to mitigate impacts at the APD stage. Direct loss of shoreline pools can be prevented by avoidance. Desert pupfish habitat could also be lost or degraded by diversion of freshwater inlets, use of the inlets or aquifers supplying these inlets and contamination of these inlets or shoreline pools.
- Flat-tailed Horned Lizard could occur within the study area although no optimal habitat has been identified. Habitat could be lost through construction or degraded because of contamination. Impacts to this species is expected to be low because of the low numbers involved. Avoidance of areas supporting flat-tailed horned lizards will greatly reduce impacts.

Because of the possible impacts to federally listed species a formal consultation with the U. S. Fish and Wildlife Service under Section 7 of the Endangered Species Act will be initiated prior to leasing.

Living Components (Vegetation and Wildlife)
Impact Summary

Zone	Acres	Impact Level	Notes
A	244,640	High	Includes Salton Sea, wildlife refuges, and habitat for Federal and state listed species.
B	49,600	Medium	Includes habitat for non-listed sensitive species.
C	15,520	Low	Common habitat within the California desert with low diversity and productivity of plant and animal populations.

D. Human Values

1. Cultural Resources

Archaeology

Impact to archaeological values could occur during all phases of exploration, development/production and abandonment, both offshore and onshore. Each phase would involve surface disturbance which potentially could destroy the context or relationships between artifacts as well as the artifacts themselves. The intensity of activity relative to the location of archaeological values would determine the degree of impact, which might range from little or no effect to complete destruction of archaeological values.

Native Americans

Impacts to locations of significance to Native Americans other than those actually containing archaeological materials can occur during all stages of exploration, development, production, and abandonment. In addition, the impacting activity need not take place on the specific location of significance to have a negative effect on the special values that location holds for Native Americans. For instance, the sacred values of some areas can be negatively impacted by development activity occurring within the view shed of that site. Since the values involved in such locations are of a sacred/religious nature and since impacts to such values cannot in most cases be mitigated, any impacts to such locations must be considered high.

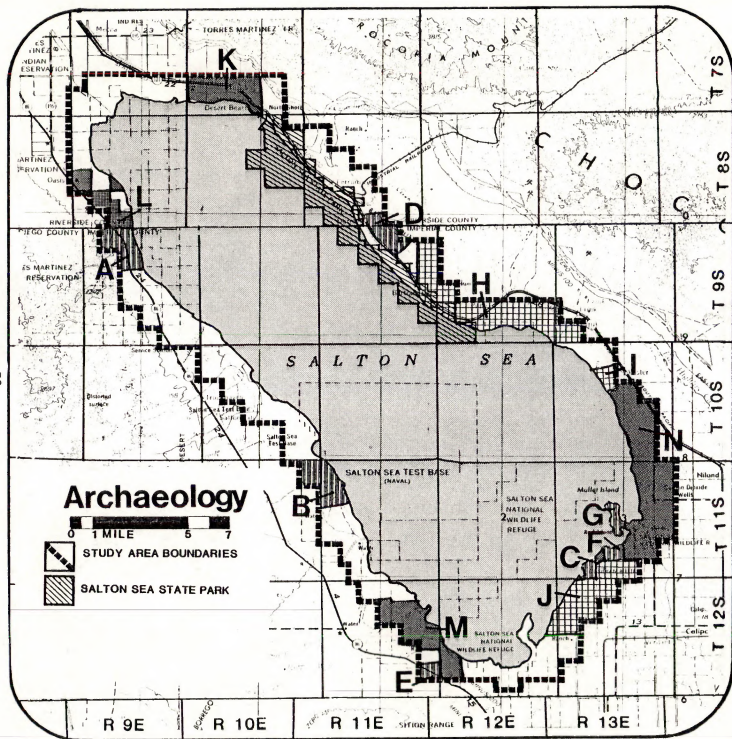
Since it is not possible on the basis of existing data to determine what areas of special significance for Native Americans exist within the study area, it is also not possible to fully assess impacts to Native American values. It is highly probable that some areas of special concern to Native Americans do exist within the study area, and these will have to be determined and considered before development on the leases takes place.

Cultural Resources Impact Summary

Zone	Acres	Impact Level	Notes
A	1,920	High	Due to destruction of known and potential resources, including petroglyphs, house rings, and lithic and ceramic artifacts.
B	1,920	High	Due to destruction of an extremely dense cluster of archaeological sites.
C	480	High	Due to destruction of an important aboriginal quarry area.
D	1,120	High	Due to destruction of a former habitation and resource exploitation site.
E	640	High	Due to destruction of an important habitation site that may contain cremation burials.
F	320	High	Zoned in previous Draft EA as having moderate potential to contain archaeological sites that would be impacted by disturbance.
G	480	High	Same as Zone F.
H	7,040	Medium	Due to potential destruction of sites, although potential for sites here may be low.
I	640	Medium	Low potential for containing sites. However, development in this area would lead to heavy disturbance of any materials present.

Cultural Resources Impact Summary
(Continued)

Zone	Acres	Impact Level	Notes
J	5,120	Medium	Same as Zone I.
All Other Land Areas	17,607	Low/No	Due to extreme level of disturbance, that renders possibility of sites here to be almost zero.
O	49,920	Unknown	Data base does not allow assessment of impacts for these areas since resource potential is unknown.
Sea	222,553	Unknown	All area is inundated.



SALTON SEA E.A.

Impacts



High



Medium



Low/No



Unknown



Map 8

2. Visual

The presence of the drill rigs, well heads, access roads, pipelines, utility lines, storage tanks, trailers, buildings, parking lots, other support equipment such as earth moving equipment and service vehicles onshore, and the associated dust, waste materials and night lighting will be highly visible to users of the Salton Sea and travelers on peripheral roads. Offshore islands, rigs, barges, and piers like the onshore items will vary in visibility to recreationist depending on the proximity to major observation points. The presence of these items will not be a major visual disruption in many areas of the sea due to the previous presence of manmade structures or lack of visitor contact.

There are, however, seven areas which have special recreational use or high visibility and have been determined to be more sensitive to visual intrusions.

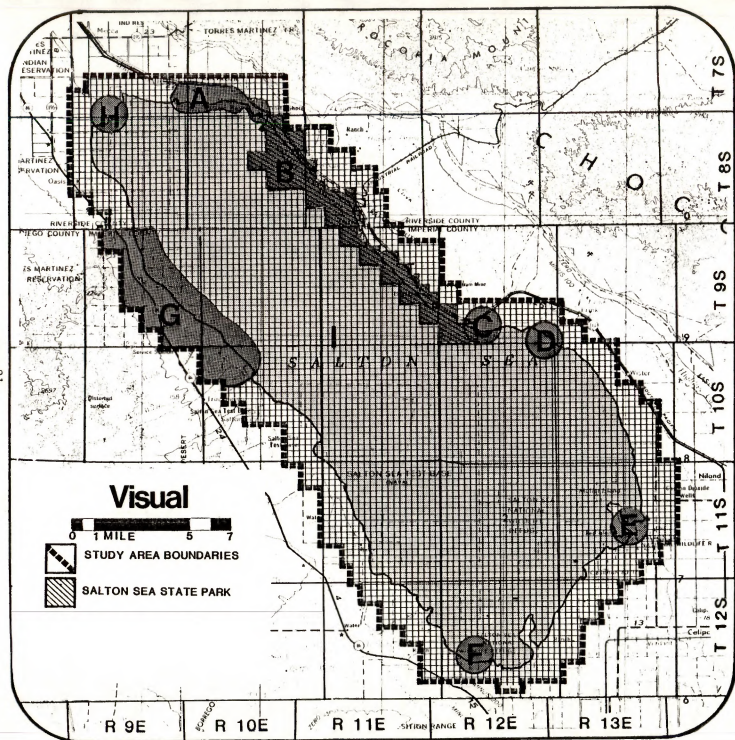
The following impact ratings are based on the premises that major visual impacts will not be long-term and that rehabilitation of areas damaged will be complete in less than 60 years. The level of disturbance has; therefore, been determined to be low for the entire study area with impacts assessed as follows:

Visual Impact Summary

Zone	Acres	Impact Level	Notes
A	5,120	Medium	Cleveland Street Drain - North Shore. Area is visible from 111, has high recreational use (fishing) and numerous existing manmade intrusions. Visual quality could be diminished if extensive development were to occur here (including private streets).
B	16,500	Medium	Salton Sea State Park - Area has high recreation use which could have visual quality disrupted.
C	640	Medium	Bombay Beach - Permanent population and high recreational use would have visual quality diminished if extensive development were to occur here.
D	640	Medium	Niland Marina - High recreation use area which could have visual quality disrupted.

Visual Impact Summary
(Continued)

Zone	Acres	Impact Level	Notes
E	640	Medium	Red Hill Marina - Nice Views from area would be disrupted if extensive development were to occur here.
F	640	Medium	Benson's Landing - Recreational use area; would have visual quality diminished if extensive development were to occur here.
G	16,000	Medium	Salton Bay Marina and Yacht Club, Lido Palms Marina, Salton Sea Beach, and Desert Shores.
			Permanent residents and marina visitors have many facilities which are heavily used. Visual quality would be diminished if extensive development were to occur in this zone.
H	640	Medium	Whitewater River Delta - presence of rigs could decrease #'s of birds for hunters and birdwatchers in addition to diminishing visual quality if extensive development were to occur in this zone.
I	268,940	Low	Low visibility, low use area would not be heavily impacted if extensive development were to occur here.



SALTON SEA E.A.

Impacts



High



Medium



Low



Map 9

3. Land Use

The presence of drilling rigs, well heads, access roads, pipelines, utility lines, storage tanks, trailers, buildings, parking lots, other support equipment such as earth moving equipment and service vehicles onshore and the associated dust, waste materials, and night lighting will be highly visible to recreationists. Offshore islands, rigs, barges, and piers like the onshore items will vary in their visibility to recreationist depending on the proximity to areas used for recreation.

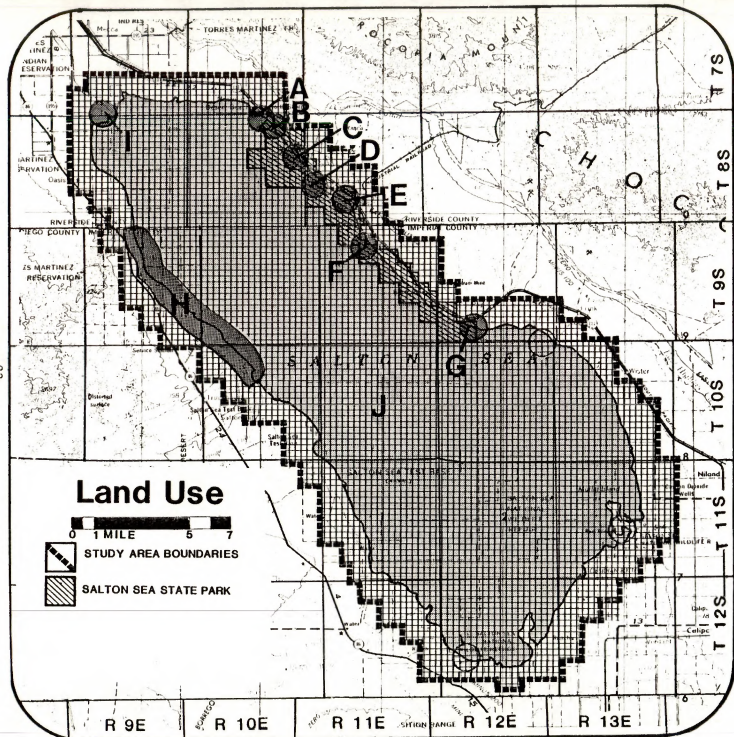
The impacts will primarily take two forms:

- (1) physical displacement of recreational activities, and (2) discouragement of use in an adjacent area due to disruption of solitude, aesthetic quality and the pristine quality of the area.

Possible impacts to fish and bird species have been discussed in the wildlife and vegetation sections. The most severe threat exists if bottom muds contains hydrogen sulfide (H_2S) or ammonia (NH_3). If disturbed, these compounds are extremely toxic to fish and invertebrates and could result in local fish kills. A complete analysis of the Sea's sediments will be necessary to determine the levels of H_2S , NH_3 , heavy metals, and pesticides in the bottom muds.

The following impacts would be anticipated if the Salton Sea was developed for gas leasing. Impacts are expected to be higher during the Development/Production phases and less so in the Exploration and Abandonment phases owing to degree of activity.

It is assumed that the level of anticipated disturbance will be low due to the fact that significant resource diminishment will not occur indefinitely and resource values will recover in less than 60 years. Impacts are as follows:



SALTON SEA E.A.

Impacts



High



Medium



Low



Map 10

Land Use Impact Summary

Zone	Acres	Impact Level	Notes
A	640	Medium	North Shore
B	1,280	Medium	Salton Sea State Park Headquarters
C	640	Medium	Mecca Beach
D	640	Medium	Corvina Beach
E	640	Medium	Salt Creek
F	640	Medium	Al and Chris and Bob's Playa Rivera
G	640	Medium	Bombay Beach
H	16,000	Medium	Salton Bay Marina and Yacht Club; Lido Palms Marina; Salton Sea Beach; Desert Shores.
I	640	Medium	Whitewater River Delta
J	288,000	Low	All other areas

4. Socio-Economics

During the exploration phase, approximately 30 persons (maximum) would be involved at any given time. During the first part of the development/production phase an additional six persons/operation would be added to the work force. In the latter phases of development/production, about six persons/operation would remain. The services and housing for these people could easily be met in the communities in which they chose to live. Income and employment would be affected only slightly. Persons owning vacant housing units may have an increased income. Retail facilities may have a slightly increased income. Taxes associated with oil and gas development and production could be translated into either increased spending for various services or into lower tax rates. Either of these actions would affect all county citizens equally.

Socio-Economics Impact Summary

Zone	Acres	Impact Level	Notes
Total Study Area	309,760	No	No anticipated impacts.

E. Alternative Action

There would be no anticipated negative impacts from the decision not to lease.

V. Mitigating Measures

A. Introduction

This chapter lists certain measures to mitigate the environmental impacts discussed in the previous chapter. These measures represent a commitment on the part of the Bureau of Land Management and the lessee that the proposed action will not be implemented without the specified mitigating measures.

B. Mitigation Measures

Leasing Stage

1. All equipment should be painted with non-specular paint to harmonize with the environment and to reduce glare.
2. Prior to any surface disturbing development, an intensive inventory of any and all areas to be disturbed must be completed in a manner designed to locate all cultural resources present. This inventory must be carried out by a professional archaeologist who is acceptable to BLM and who holds a currently valid Federal Antiquities Act Permit.
3. Where technically feasible, all cultural resources shall be avoided by slant drilling, or shifting roads, well sites, and other facilities to areas away from sites at distances to be determined by BLM archaeologists in consultation with the archaeologist performing the inventory.
4. In areas where avoidance is not feasible, or in areas where indirect impacts cannot reasonably be controlled (e.g., increased visitor access, ORV activity, or other indirect impacts) a thorough multidisciplinary data retrieval program shall be completed for all cultural resources affected. This data retrieval program shall be performed by qualified professional archaeologists acceptable to BLM and who hold a currently valid Federal Antiquities Act Permit, using methods approved by BLM. The materials collected shall be analyzed from a problem-oriented standpoint to contribute toward an understanding of the history and prehistory of the Salton Sea area, particularly as it related to Lake Cahuilla. The collection and analysis of these materials shall result in a written report made available to the public. All cultural materials collected shall be preserved in an accredited public museum and remain available for future study.

5. All operations shall receive information on the importance of cultural resources and the need to protect them. Operations shall make employees aware of legal sanctions against collecting or disturbing cultural material on public lands.
6. Prior to any surface disturbing activity, and in conjunction with the inventory for archaeological materials, appropriate Native American groups/individuals shall be contacted by a qualified ethnographer to determine whether or not sensitive areas will be impacted by the action. If any such sites are located, all attempts shall be made to avoid disturbance of these areas.
7. No new access routes to or through onshore habitats with a High Sensitivity rating will be provided.
8. No offshore surface occupancy will be allowed within 2 miles of the shore and within 1 mile of the submerged US Fish and Wildlife refuge land at the south end of the sea. This area is a rafting concentration area for diving ducks and other waterfowl on the Salton Sea. It also includes the most reliable production zone of Neanthes, a vital element in the food chain of the Sea's sport fishery.
9. No surface occupancy will be permitted in onshore habitats with a high sensitivity rating.
10. No surface occupancy will be permitted in T. 8 S., R. 11 E., Section 1-4, 9-16, 21-29, and 33-36. These sections include desert pupfish habitat and may be proposed as critical habitat.
11. Shoreline ponds (which will be identified prior to the APD) will be avoided for the protection of desert pupfish.

Operational Stage

12. The lessee shall prepare a Spill Contingency and Countermeasure (SPCC) plan prior to commencement of drilling activities. The SPCC plan shall meet all applicable state and EPA requirements. The lessee shall submit one copy to each of the appropriate BLM District and Resource Area offices for their reference.
13. All deck drainage from any drilling platform offshore shall be run through an oil-water separator.
14. Standby pollution control equipment consistent with the state of the art, shall be maintained by, and immediately available to, each operator. All members of the drill crew shall be trained in the use of the equipment.

15. In any or all drilling operations offshore, the lessee or lessee's operator may be required to comply with any or all of the USGS OCS orders;
16. A Blowout Prevention (BOP) drill may be required by a USGS designated representative or BLM authorized officer at any time during the drilling operation, after notifying and consulting with the lessee's senior representative present.
17. Where possible, subsea well completions will be required.
18. All permanent equipment (in location over 6 months) should be painted with non-specular earth tone paints to harmonize with the environment.
19. No drilling muds, cuttings, formation liquids or other waste will be discharged into the Sea.
20. Onshore sumps will be lined with an impermeable material to prevent leaching. Sumps will not be placed in areas where the Salton Sea, freshwater inlets, shoreline pools, or mud flats could be accidentally contaminated if sump lining fails.
21. Screens will be placed over all sumps to prevent birds and other wildlife from entering.
22. Berms will be built around all onshore drilling pads in such a manner as to control all fluids anticipated during an accident or blowout. No fluids will be allowed to enter the Salton Sea or associated drainages, natural or manmade.
23. Construction of any kind, including roads and pipelines, will not block existing drainage patterns.
24. Freshwater inlets or the aquifers supplying those inlets will not be utilized for production or domestic use.
25. All recreation areas which received sustained use (high sensitivity) should be avoided by slant drilling, or shifting roads, well sites, and other facilities to areas away from use areas.
26. All high sensitivity visual zones should be avoided by slant drilling or shifting roads, well sites, and other facilities to areas away from the sensitive zone.
27. Prior to the approval of an APD involving any sediment disturbing activities, including dredging, or piling placement, the lessee may be required to prepare a complete sediment analysis (including trapped gases, heavy metals and pesticide levels and the effects on eggs, larvae and adult Salton Sea fish and invertebrates). The results will be made available for inclusion into the environmental assessment of that permit.

28. Above-ground pipelines should be built 1 foot (.3 meter) above the ground to allow for the mobility of small animals and so as not to interfere with natural drainage.
29. Powerpole designs and arrangements of wire will follow the suggestions as outlined in the Report No. 4, Raptor Research Foundation, Inc., 1981. This will reduce losses of raptors and other birds from electrocution.
30. Revegetation, using species native to the EA area, will be attempted on all cleared areas and roads as soon as is feasible using the latest methodology for revegetating areas of the desert.
31. Prior to the approval of an offshore APD the currents of the area will be analyzed by the leasee and the information provided for input into the environmental assessment of that permit.
32. Mitigation for wildlife also will include habitat compensation and improvement which should be considered during the plan of operation phase. Any compensation or habitat improvement should be closely coordinated with the Department of Fish and Game and the Salton Sea refuges.
33. Prior to the approval of an onshore APD the area involved will be inventoried for flat-tailed horned lizard. The survey will be conducted by a wildlife biologist approved by the BLM utilizing the techniques used by Turner in 1979 or other approved techniques. Those areas supporting the flat-tailed horned lizard will be avoided.
34. Prior to the approval of an offshore APD the leasee must provide a statement from a BLM approved biologist that the proposed development will not adversely affect corvina spawning in the Salton Sea. Corvina is the dominant sport fish in the Salton Sea and impacts to the spawning of this fish could seriously impact the entire sport fishery of the Salton Sea.
35. Prior to approval of an APD, a vegetation survey of the sensitive species will be made by a botanist approved by BLM. A report of the survey, including a species list and mapped locations of any sensitive plant species will be made available for input into the EA.
36. If a blowout or accidental discharge of formation liquids results in a spill beyond the boundaries of the drilling site, a BLM biologist will be consulted immediately on appropriate cleanup procedures.
37. A buffer zone of 1/4 mile around high sensitivity marshland and shoreline will be established with no surface occupancy to reduce the impacts of intrusion and noise on sensitive wildlife.

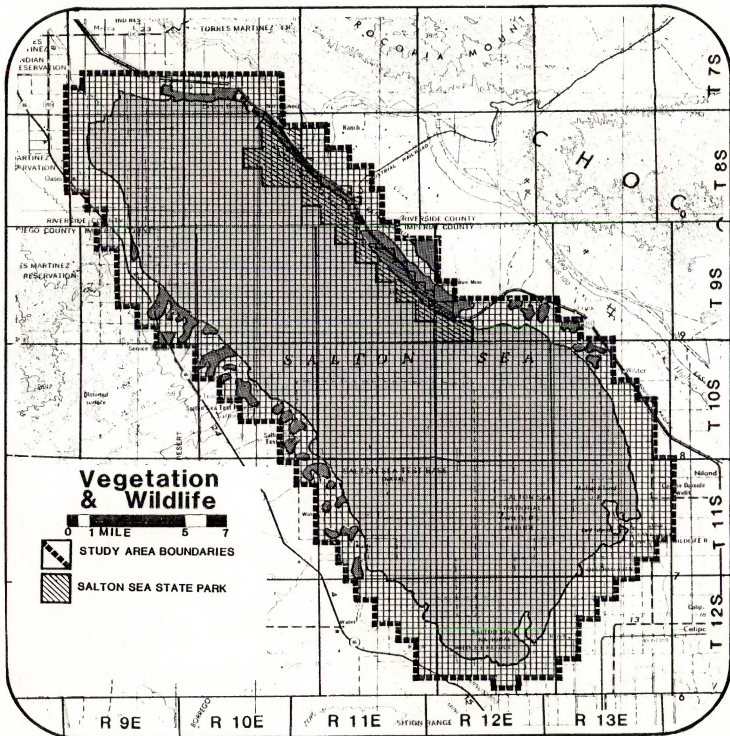
VI. Summary of Anticipated Impacts after Mitigation

Proposed Action

Resource	Zones	Acres	Impacts Before Mitigation	Impacts After Mitigation	Mitigation Measures	Notes
Geology	Total Area	309,760	No	No	None	No anticipated impacts.
Water Resources	Total Area	309,760	No	No	14-19, 22, 23, 25-29, 32	No anticipated impacts.
Air Quality	Total Area	309,760	Medium	Medium	17-19	Due to emissions and dust.
Climatology	Total Area	309,760	No	No	None	No anticipated impacts.
Vegetation and Wildlife	A	244,640	High	Medium	7-17	No surface occupancy is recommended in areas of high sensitivity. Studies will aid in placement of rigs to avoid sensitive areas. Mitigations reduce chance for contamination if accidents should occur, and reduce impacts of powerline and pipeline construction.
	B	49,600	Medium	Medium	19-37	
	C	15,520	Low	Low		
Cultural Resources	A	1,920	High	High	2-6	Assuming a moderate level of disturbance due to data collection on a high sensitivity area. Information on sites would be collected and curated, but site location and context would be lost.
	B	1,920	High	High		
	C	480	High	High		

Resource	Zones	Acres	Impacts Before Mitigation	Impacts After Mitigation	Mitigation Measures	Notes
	D	1,120	High	Medium		Information could be collected and curated. Some data would be lost. Reduced possibility for sites here.
	E	640	High	Medium		
	F	320	High	Medium		
	G	480	High	Medium		
	H	7,040	Medium	Low		Data can be collected before development.
	I	640	Medium	Low		
	J	5,120	Medium	Low		
	K-N	17,607	No	No		Very little potential for sites here, so impact should be very little.
	All Other Land Areas	49,920	Unknown	Unknown		Cannot assess impacts on the basis of existing data.
	Sea	22,553	Unknown	Unknown		
Visual Resources	A	5,120	Medium	Low	1, 12-19, 26, 30	Avoidance of sensitive areas.
	B	16,500	Medium	Low		
	C	640	Medium	Low		
	D	640	Medium	Low		
	E	640	Medium	Low		No change.
	F	640	Medium	Low		
	G	16,000	Medium	Low		
	H	640	Medium	Low		
	I	268,940	Low	Low		No change.

Resource	Zones	Acres	Impacts Before Mitigation	Impacts After Mitigation	Mitigation Measures	Notes
Land Use	A	640	Medium	Low	12-16, 19, 20, 22-27, 30-32, 34, 36	Avoidance of sensitive areas. Low indirect impacts caused by development on adjacent parcels.
	B	1,280	Medium	Low		
	C	640	Medium	Low		
	D	640	Medium	Low		
	E	640	Medium	Low		
	F	640	Medium	Low		
	G	640	Medium	Low		
	H	16,000	Medium	Low		
	I	640	Medium	Low		
	J	132,827	Low	Low		No change.
Socio-Economics		309,760	No	No		No anticipated impacts.



SALTON SEA E.A.

**Impacts after
mitigation**



High



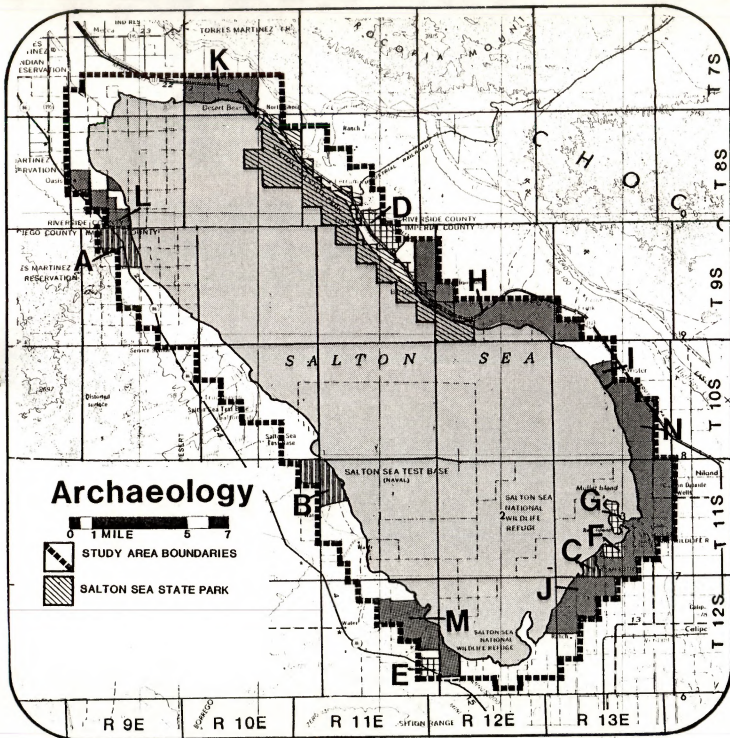
Medium



Low



Map 11



VII. Unavoidable Adverse Impacts

A. Introduction

This chapter describes the adverse impacts which could be expected to remain after the applicable mitigation measures in the preceding chapter have been applied. These impacts are therefore considered unavoidable.

B. Non-living Components

Emissions could be released into the environment and cause a reduction in air quality. This is expected to be minor and short term.

C. Living Components

Vegetation and Wildlife

Onshore

In habitats rated moderately sensitive, the major impact after mitigation will remain the loss of habitat due to the construction of drill pads, support facilities, pipelines, and powerlines. Because habitats rated moderately sensitive constitute the largest percentage of the study area onshore, it is likely that they will receive the largest portion of the onshore development. The construction of new roads may result in increased use of the area by vehicles, particularly if the road provides access to the Salton Sea. Construction-related activities will encourage the invasion of weedy plant species into disturbed areas. An increase in noise and human presence will degrade the wildlife value of areas surrounding drill pads, support facilities and roads.

In the unlikely event of a blowout, drill muds and cuttings would be ejected from the well and dispersed around the drill rig. In most cases these would be contained on the drill site. Appropriate cleanup procedures will be initiated immediately. Saline formation water could sterilize soils in affected areas.

No impact is expected to occur to known localities of the sensitive plant species (*Salvia gregata*, Orocopia Sage). The areas including and surrounding documented sites of this plant have been recommended for no surface occupancy due to high wildlife values for desert pupfish. In most cases, all flat-tailed horned lizard habitat will be avoided. However, this species is rarely observed in high numbers, and in the marginal habitat within the study area small populations could be missed with the existing survey techniques.

No major residual impacts to areas of high sensitivity are anticipated from onshore development.

Impacts to Yuma Clapper Rail, California Black Rail and desert pupfish have been mitigated through avoidance. Residual impacts would occur from accidental spillage or blowout. In most cases the contaminants would be contained before reaching shore. Information on the currents of the Salton Sea as well as the location of well sites, which will be provided with the APD, will allow for a more accurate assessment of these residual impacts.

Offshore

Offshore residual impacts to wildlife include those related to bottom disturbing activities and those related to an accidental blowout. The sinking of pylons or other anchoring devices will temporarily increase local turbidity and resuspend organic materials. This will probably serve as an attractant to fish except in areas where the levels are intolerable. These areas will be avoided by fish. Some sedentary invertebrates will be lost in the immediate area but key areas are protected through mitigation. Once structures are in place they will probably be colonized by barnacles and serve as an attractant to fish.

A blowout or accident offshore could result in the loss of drill muds and cuttings into the Salton Sea. Studies on the effect of drill muds and cuttings have shown insignificant damage to marine environments in the open ocean. Impacts in the Salton Sea because it is a closed system are likely to be magnified. These include burial of sedentary invertebrates and changes in the bottom substrate which may prevent recolonization of the area. The accidental discharge of saline formation water into the Sea could have a local affect on sedentary invertebrates, larval fishes and fish eggs.

D. Human Values

1. Cultural Resources

Residual impacts to archaeological sites have been assessed based upon the following assumptions:

- a. Recommended mitigation measure #5 (avoidance) if followed, will result in no direct impacts, since no activity will take place at archaeological sites. Indirect impacts might still occur.
- b. Mitigation by data retrieval (mitigation measure #6) produces medium impacts upon archaeological sites, because although the site itself may no longer exist physically in its original location, all scientific data possible is obtained and artifacts and other materials are curated and available for future use and study.

Impacts after mitigation have been mapped based upon the moderate impacts caused by data retrieval. Impacts will be lower where avoidance is used.

Assuming a median level of disturbance, impacts exceed low levels in all high and medium sensitivity areas. These are all areas in which significant sites or clusters of sites (Zones A-C and E) have been recorded; moderately significant sites (Zone D) have been recorded; or a high to moderate probability exists for such sites (Zones F and G).

The possibility of additional residual impacts exists if other areas of special significance to Native Americans are determined to be present within the study area.

2. Visual

There will be some temporary loss of visual quality and diminishment of user enjoyment due to the presence of the equipment and related disruptions necessary to conduct this project. Impacts, however, are anticipated to be rehabilitated in less than 60 years.

3. Land Use

Due to the presence of drilling equipment, machinery and personnel some recreation activities will be disrupted for varying lengths of time and to varying degrees. After abandonment of operations all activities can return to the state prior to commencement.

VIII. Persons, Groups and Government Agencies Consulted

- Pat Welch, Archaeologist, El Centro Resource Area
- Bob Laidlaw, Ethnographer, California State Office, Bureau of Land Management
- Utah State Department of Oil and Gas
- U. S. Geological Survey, Los Angeles Offshore Office
- Bureau of Land Management, Outer Continental Shelf Office, Los Angeles
- U. S. Geological Survey, Bakersfield
- Bureau of Land Management, Outer Continental Shelf Office, New York
- Bureau of Land Management, Outer Continental Shelf Office, New Orleans
- Bureau of Land Management, Caliente Resource Area, Bakersfield
- U. S. Fish and Wildlife Service, Laguna Niguel
- U. S. Fish and Wildlife Service, Salton Sea National Wildlife Refuge
- California Department of Fish and Game, Salton Sea State Wildlife Refuge
- Penzoil Exploration Production Co., Houston
- Chevron USA, Inc., San Francisco
- Dr. Eugene Anderson, Department of Anthropology, University of California, Riverside
- Dr. Larry C. Oglesby, Department of Biology, Pomona College, Claremont

IX. Intensity of Public Interest

A draft environmental assessment (EA) on the potential impacts resulting from the leasing of the oil and gas resources in the Riverside County portions of the Salton Sea was released in November of 1980. Public opinion at that time indicated extreme disapproval of any leasing in the Salton Sea. Fears of an oil spill were the main concerns. Many members of the public and many agencies requested that an Environmental Impact Statement be formulated to properly address the severe impacts anticipated. Public meetings were held in December 1980 and June 1981 to keep the public informed and to solicit their comments and opinions on this action.

Due to additional lease applications received on the Salton Sea, the study area was expanded in the second draft to include the entire sea. The study area encompassed both Riverside and Imperial counties. Due to the fact that the public had had extensive input into the first draft and due to budget constraints which made mass mailings prohibitive, the decision was made to have a limited scope public review on the second draft. Copies of the draft were mailed to agencies and individuals who had in the past presented technical data to the BLM on the Salton Sea. In order to get maximum exposure from as few copies as possible, copies of the EA were sent to the Mecca/North Shore Library in Mecca, the North Shore Bookmobile and the Salton Sea State Park Visitor Center. The public was informed of the locations by local newspaper releases and ads run in local newspapers. In addition, a public meeting was held on March 13, 1981, at Oasis School in Oasis, California, to give the public an opportunity to give testimony on the decision to lease or not.

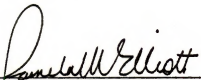
X. Participating Staff

<u>Name</u>	<u>Position</u>
Faye J. Davis	Wildlife Biologist
Pamela M. Elliott	Team Leader, Environmental Coordinator
Rebecca R. Knehr	Typist, Editor
Robin L. Kobaly	Botanist
Judyth E. Reed	Archaeologist
Matthew W. Shumaker	Geologist

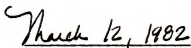
XI. Management Approvals

The environmental impacts of the proposed action have been assessed. I conclude that the proposed action is not a major federal action which would significantly affect the quality of the human environment. Preparation of an environmental impact statement pursuant to Section 102(2)(c) of the National Environmental Policy Act of 1969, is not required.

Recommended by:



Pamela M. Elliott
Team Leader




Date

I concur:




Russell L. Kaldenberg
Acting Area Manager




Date

I concur:



Gerald E. Hillier
District Manager



Date

APPENDIX

Group Memory of June 20, 1981, Public Meeting

OBJECTIVES

1. Identify important issues relating to oil and gas leasing in the Salton Sea (brainstorm)
2. Prioritize issues
3. Environmental Assessment on North Salton Sea or whole Salton Sea

GROUP 1

A. Top Issues

1. Jurisdictional responsibility
2. Operational responsibility
3. Site responsibility
4. Disposal of waste material
5. Mitigation of adverse areas of impact
 - a. Sight enforcement
 - b. Navigation
6. Transportation method of resources
7. One agency that ties all other agencies together - task force
8. Protection of fish, wildlife, and recreation

B. Other Issues

1. Other wildlife habitats should also be considered
2. Concern about slant drilling onto private property
3. Can they drill on land instead of sea?
4. State Parks that are leased from the government should not be leased for oil and gas
5. Chevron must adhere to State air quality standards
6. Government should take on responsibility for fishery impacts on Salton Sea
7. Chevron or government supply a bond for clean-up of sea if there is a spill
8. Visual impact

C. How Should Salton Sea be Handled?

The whole sea should be considered except for Indian lands

D. Other Comments

1. Protection of fish
2. Who [is] responsible for management of operations?
3. Residue/by-products from drilling operations. How disposed?
4. Criteria for meeting the physical day-to-day operations
5. Who is responsible for the day-to-day operation? Who enforces this operation?
6. Salton Sea in two counties:
 - Imperial County
 - Riverside County
7. Where does the money come from?
 - Chevron?
 - Government?
8. Is Chevron going to get money from the government? What cost to the taxpayer?

9. Fragmented operations proposed on the sea. Who is responsible?
10. Who is responsible for boat traffic?
11. Why can't Interior Department coordinate?
12. Are we willing to give up sports fishing for oil and gas?
13. Law says government can't allow action that would kill sports fishing!
14. Desert Plan didn't consider Salton Sea and protect it!
15. Ask for protection.
Group has asked for a task force to regulate the Salton Sea
16. Want group of people to see what happens to Salton Sea - citizens.
17. Salton Sea important recreation area
18. Economic ratio between oil/gas and recreation
19. Authority similar to Tahoe Regional Counties
20. Riverside County has not responded to oil/gas lease
21. What might positive impacts of drilling be? Positive impacts affecting salinity. Injection of Salton Sea water to reduce subsidence.
22. Indian Reservation lands - should they be considered separately by BLM process?
23. Same regulations regardless of ownership
24. Air quality - what effect?
25. Earthquakes - how [will they] effect wells? Create potential for release of high pressure gas?
26. Effects of natural gas blow out!
27. Does the State get money from producing wells?
28. Can a portion of that money be used for recreation?
29. So many agencies control [the] Salton Sea - who is responsible for the "Whole Sea"?
30. Does the government have the right to let a lease and supersede county laws?
31. Use the Army Corps of Engineers Plan process similar to White-water area?
32. We have not looked at future of Salton Sea as a growth center.
33. Proximity of drilling to homes and communities
34. Should we treat Salton Sea as a whole unit?
35. Contact duck clubs (22) in Riverside County for input.
36. Department of Defense lab to determine effect of spill in warm water bodies - Hanover; MD.
37. Input from Fish and Game must be taken into consideration - they built the fishery.
38. Task force should be made up 1/2 non-government employees (people that live in the area)?

GROUP 2

A. Top Issues

1. If an oil spill occurs, can the oil be captured or will it go into the Sea? (12 votes)
2. Have considerations been made towards the Central Arizona Project and its effect on the level of the Salton Sea? (11 votes)
3. Fishery emphasis should be placed on it. (11 votes)
4. Air pollution from drilling operations. (Hit toxic gases.) (11 votes)
5. Gas leaks - what are the dangers? (11 votes)
6. Are the environmental issues the same for the entire Salton Sea? (10 votes)
7. Impairment of view for private landowners and businesses - are there controls? (10 votes)
8. Effect of spilled oil on fishing - what safeguards will be provided? (10 votes)
9. Earthquake faults - how will this be affected? What will earthquakes do to gas pipelines? (10 votes)
10. Will temperature of Salton Sea change (geothermal) (oil and gas)? (8 votes)

B. Other Issues

1. Keep in mind that oil and gas are necessary to all of us - if it can be done without harm, it should be done to benefit public. (7 votes)
2. Influx of development and operational personnel. Numbers of people; housing needs, business needs. How [will this] effect local economy? (6 votes)
3. How are USDI leasing procedures subject to change due to change in administration? (4 votes)
4. Maintaining level of the sea. How will it be done? (3 votes)
5. High (tall) powerlines crossing the southern Salton Sea. (Mentioned at Niland meeting.) (3 votes)
6. Slant drilling for exploratory drilling. (0 votes)
7. Is identity of lease applicants public information? Place a list of names in document. (0 votes)

C. How Should Salton Sea be Handled?

Assessment for whole sea - 13 votes

Assessment for North Salton Sea only - 0 votes

D. Other Comments

1. Where are the 27 sections of land to be leased on the North Salton Sea?
2. Has Chevron considered the changing level of Salton Sea, and are they planning to control the level?
3. If assessment proves negative, where does decision lie regarding whether or not to drill?

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